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A TRANSPACIFIC CABLE.

Every year that passes points to the increasing desirability of telegraphic cable communication between the North American continent and Asia or Australia. At present every message sent to China or the Philippines from San Francisco or New York costs several times as much as if direct communication existed. The telegraphic bill which the United States government has to pay for its messages to Manila must, no doubt, be a cogent argument, to say nothing of Hawaii. On the other hand, the British Colonial interests of Australia and Canada call for a direct communication between those countries. We may, therefore, expect that at least two cable routes will be developed in the future, one between the United States and the Philippines via Hawaii, and the other between Canada and Australasia. Meanwhile, a Canadian-Australasian cable would largely suffice for the temporary needs of the United States. Between the two enterprises, it is difficult to say which will first be fulfilled. Both involve a large amount of outlay and the engineering difficulties involved, although not in any way insuperable, are unusually great. It may be, therefore, that some subsidies will be necessary to accomplish either project. Meanwhile there is no immediate likelihood of wireless telegraphy supplanting the ocean wire, but there is a likelihood of a comparative dearth in rubber and gutta-percha.

A PLACE FOR ELECTRIC LOCOMOTION.

At the recent convention of the American Society of Civil Engineers, the attention of the members was turned in a casual way, by a topical discussion, to a consideration of steam and electricity for purposes of traction in the operation of branch lines. It was obvious from the discussion that a certain amount of vagueness still, and necessarily, attends this question. A great many engineers yet treat it as a matter which involves the continuance of old conditions with the substitution only of an electric locomotive for one propelled by steam. Others again, if electrical, assume that a branch line is little more than an enlarged street railway system, and speak or act accordingly. Now it is obvious that "branch line" is a phrase of remarkable elasticity, and that the distinctions between main and subsidiary may be subject to a good many varieties of differentiation. Another point is that it is certainly no longer a question of retaining the locomotive, as such, so that an entirely new method of handling traffic, with single or double self-propelled units may come into play, with the adoption of electricity.

Over on Long Island, on some parts of the railroad one can see trolley work hanging right over the tracks upon which steam locomotives are plying. The electric system is to take care of the "suburban service," and yet the lines are "branch." In this case, it is difficult to understand why the whole thing is not done electrically, but it is another indication of the slow approach with which old school steam engineers are coming to the inevitable. It is tolerably plain that the steam railways in adopting electricity are not likely to be led into unduly great expenditure on an untried innovation by the extravagant enthusiasm of their present advisers. And after all it is best that the change should not come with a rush.

THE DETROIT DECISION.

From time to time attention has been called in these pages to the steps that were being taken in Detroit to transfer the electric railway system there from private to public ownership. An act of the Legislature known as the McLeod law provided for the appointment, by the Mayor and Common Council of Detroit, of commissioners who were empowered to buy or lease the system and then to maintain and operate it. They were given a free hand as to price and were, in fact, permitted by the law to operate the system broadly on their own discretion.

We have ventured to comment somewhat unfavorably on the plan as involving many objections of various kinds, and the Supreme Court of Michigan has now given it a quietus for the present by declaring the McLeod law unconstitutional. The court has found that the law proposed to give the city power to engage in a work of internal improvement, whereas this is expressly contrary to the state constitution, which provides that the State of Michigan cannot become in any way directly interested in internal improvements; the law further providing that the Legislature cannot empower municipalities to do that which is forbidden to the state itself. The acquisition and operation of street railways falls directly under this ban, and hence the law cannot be carried out.

Michigan has had two or three very severe lessons in regard to losses incurred from public operation or ownership of general services, and is hardly likely to revise its constitution to meet this emergency. We are interested to note the development of this situation as regards street railways, but on such a reading of the constitution it seems to us that the city of Detroit is already involved in grave illegality in owning and operating its municipal electric light plant. That is surely a work coming under the head of "internal improvements," so that the city has no right to be engaged in the enterprise, even if it were making money. We suggest to the electric light companies of Michigan, many of which have been harassed with threats of practical confiscation as a reward for their energy and enterprise in going into the electric light industry, that they might be doing the public and themselves a great service by bringing this very question to a decision before the same high legal authority.

As we go to press it is reported that there will be an evasion of the issue by the vote on July 11 of the City Council to give a thirty-year six-for-a-quarter franchise ordinance to the Detroit Municipal Railway, which will buy the system for $17,500,000 and pay for it out of the receipts. The Mayor promises, however, to veto this in turn.

NO FLIES ON AUTOMOBILES.

The caption to this editorial item looks rather slangy, but is indeed only the plain matter-of-fact expression of the views of a government entomologist who has been studying the automobile situation. According to this authority, with the automobile there will be less opportunity than ever for the fly to exist and propagate. The horse-fly in particular will have to go. It is intimated that while this fly is not exactly a parasite of the horse, it has no raison d'etre unless the horse is around, and that with the disappearance of all the unsanitary conditions due to the horse, the fly must perish off the face of the earth. We are not aware that the authority cited has any prejudice against the horse, but when it has been pointed out in these columns how much the horse does to spoil the streets, to crowd out human beings with its stables, to create dust and disease, and in general to render life less pleasant for man in the city, it has been urged that we are discreditably holding a special brief for the automobile. That is a narrow view to take. No one asserts now that the engineering and mechanical papers have a grudge against the horse or the ox or the mule because they preach the excellencies of the locomotive, the steamship, the gas engine and the power press. To recognize the fact that the horse in cities is an anomaly and an anachronism may not after all be a sin. Neither is it a special virtue. It is common sense.

It affords us much pleasure to print this week the decision of a judge in Chicago upholding the right of any one to drive an automobile for pleasure in the parks and boulevard system there. Those who have fought to secure this victory are to be congratulated on the success of their efforts. The decision as the first of its kind in this country is necessarily "historical," and it does indeed at once constitute a precedent and a starting point. It will be quoted and appealed to, and while there may still be obstruction offered in other places, such as Bar Harbor, the Chicago decision will not only stand but become universal in its application. There were in fact no good grounds upon which the commissioners could base their opposition. Curiously enough, while they were saying that automobiles would cause horses to shy, newspapers in this city were remarking that with the increase of automobiles, as shown on the Fourth of July, the number of shying horses would tend to decrease chiefly because there would be so few sensitive animals left to take offence at crackers, passing objects and trifles of all kinds.

While automobiles are thus gaining an entrance into the parks, they are not less successful in the thoroughfares devoted to industry and commerce. The figures given by Messrs. Sever and Fliess at the recent Institute meeting on costs of automobile operation, go to show that an electric delivery wagon even at this early stage is capable of saving practically about one dollar a day as compared with a horse-hauled wagon. The data given in the paper printed in these columns last week was most carefully worked out and convincing in its results, and yet it emphasized only one side of the gain that the modern automobile insures for the public.

HISSING ELECTRIC ARCS.

A very interesting paper on the hissing of electric arcs by Mrs. Ayrton is published in the June number of the Journal of the London Institution of Electrical Engineers. We are all familiar with the fact that under certain somewhat uncertain conditions of overload in current, an arc which has been burning silently, suddenly commences to hiss, the phenomenon being accompanied by a considerable fall in voltage between the carbons, and, in most cases, by a vigorous shaking up or readjustment of the carbon-feeding mechanism. The paper describes a number of experiments and measurements made to determine the nature and origin of this well known contumacious behavior of an arc. Mrs. Ayrton appears to have demonstrated that an arc hisses as soon as its cup overflows; i. e., as soon as the crater in the positive carbon breaks its walls, and the arc commences to ascend the side of the positive carbon. So long as the crater is kept within the sides of the carbon, or at the end of the positive carbon, the arc is silent, but the moment the crater expands so as to leave the end and cut into the side wall, the hissing promptly commences.

The cause of this remarkable phenomenon appears to be the partly rhythmical disturbance due to combustion. In the silent arc, the only combustion that can take place is at the exterior surface of the cloud of incandescent vapor which fills the crater and enshrouds the negative tip. But in the hissing arc, air is able to gain more or less complete access to the highly heated surface of the crater, and this is accompanied by direct combustion of the carbon at the crater's surface, with semi-rhythmical rapid alternate heating and cooling. The drop of pressure which occurs is about 10 volts, but is shown to vary slightly with the length of the arc, less pressure and power being required to heat the crater to the combustion point than to heat

it to a volatilizing point. It is shown that if air or oxygen be artificially introduced into the crater of a silent arc, hissing will be set up, while if nydrogen or carbonic dioxide be so introduced, in moderate quantity, hissing is not brought about. The results explain a number of the well-known phenomena of arc lamps, as for example, the silence of the enclosed arc, since the oxygen of the air, which is the offending element, has been effectually excluded. The paper is worthy of study as showing how a subtle and apparently very complex phenomenon may be explained and elucidated by systematic search.

A remarkable fact to which attention is incidentally called, is the sudden and almost explosive rise of pressure in a chamber closely surrounding a pair of arc carbons as soon as the current is passed through them. It appears to have been ascertained that this pressure is greater than can be accounted for on the supposition that the air is expanded in the neighborhood of the suddenly heated carbons. It has been suggested that occluded gases are suddenly expelled from the carbons themselves, but the matter does not appear to have been properly investigated and should form an interesting subject for experimental research.

THE PROTECTION OF SECONDARY CIRCUITS.

In the two papers recently presented respectively by Mr. W. L. R. Emmet before the National Electric Light Association and Dr. Cary T. Hutchinson before the American Institute of Electrical Engineers, the risk of fire due to the insulation of secondary circuits from ground was well pointed out. A greater risk due solely to the same cause, about which very little is said but the seriousness of which every one connected with alternating central station service realizes, is the risk to human life.

In case the insulation of a transformer is defective the insulation between the secondary wiring and ground may or may not give way. If the secondary wiring is in wooden premises with no combination fixtures the probabilities are that it will not. Even if it does give way it may in doing so establish a dead ground that causes no immediate danger to life or property, but if it does not it remains a hidden menace to the former. No warning is given until some one handling a portable lamp comes in contact with grounded piping or steps upon moist cement flooring when, too late, the danger becomes apparent. Protection against this danger is easily given by means of automatic short-circuiting or open-circuiting devices, designed to either ground the secondary or cut off the primary if a cross-section exists between the two. The time element involved in their operation is no disadvantage in the protection against this danger as it is in the protection against fire risks. The best protection, however, is obtained by means of a permanent connection between the secondary and ground, owing to its simplicity and consequent reliability. With such a connection no greater voltage than that of the secondary system, generally 110 volts, exists between any part of the same and ground and the risk of serious shocks on consumer's premises is rendered nil.

In large systems this risk and to a certain extent the risk of fire exist whether there is or is not any other ground upon the primary wiring. This is due to the large capacity of an extensive underground network. Dr. Hutchinson overlooked this point, owing to his assumption that "the capacity of the primary system will probably be a fraction of a microfarad." While this is true of overhead work, the capacity of underground cables of about 500,000 circular mils cross-section with rubber or similar insulation about three-sixteenths of an inch in thickness is in the neighborhood of 1 microfarad per mile. With extended networks of 50 or 100 miles of primary wiring electrically interconnected at a main switchboard supplied by alternators working in parallel, the capacity current in case of a single ground on the system is considerable and often becomes disastrous. Taking Dr. Hutchinson's own figure of three-quarters of an ampere per microfarad on a 2000-volt 60-cycle system, a network of about 80 miles of feeders with the properties above mentioned will give a condenser current of some 60 amperes. This is in many cases reinforced by the capacity of other phases electrically connected through the windings of the same generators. The currents caused thereby often prove very vicious, especially if the ground is one of high resistance in which they may generate considerable heat, frequently starting in ducts or manholes, arcs which burn out a whole conduit. Largely on this account central stations are coming to provide isolated generators or electrically isolating transformers, on to which feeders may be thrown as soon as leakage to ground occurs upon them.

Returning to the question of the protection of human life, a leading consideration in the use of low-pressure electric circuits is their safety to manipulate. If, however, a danger exists of a cross between the normally low-pressure circuit and a high-pressure circuit in the neighborhood, this consideration is not only removed, but it assumes a negative value; because, lulled into a false sense of security, we may manipulate and operate the so-called low-pressure system in such a manner as to endanger either our lives or our persons or both. In the case of transformers supplying incandescent lamps or motors in buildings, it is very important that the secondary circuits should be safe to handle and install. Nevertheless, we know that the primary and secondary circuits are brought into close juxtaposition in the transformer, and that it only requires an oversight in manufacture, or a secondary lightning stroke, or some trivial accident, to bring the two circuits into actual contact. Under these circumstances there should be inserted in the secondary circuit some automatic device which will instantly ground the secondary circuit in case of a contact. The most certain device for accomplishing this purpose is the direct grounding of the secondary circuit. Such grounding is best effected at the centre of the transformer for the sake of symmetry of pressure.

It is, of course, evident that such grounded circuit is a source of danger in itself, seeing that the moment a ground is made on either side of the low-pressure circuit, a current will flow through the ground with a strength and effect depending upon the conductance of the accidental ground. Under particularly favorable circumstances, such a ground might no doubt set fire to inflammable materials in the neighborhood. But the danger which so exists is considerably less than the danger which would lurk in a non-grounded circuit, because the electric effect, whatever magnitude it might assume, would be produced at the instant of the accidental grounding, when, presumably, the person who caused said grounding was present and would be unable promptly to extinguish any blaze which might break out. If, for example, a man made a ground with chisel or sharp instrument cutting into an electric main, the flash would occur instantly under his tool; whereas, a non-grounded circuit would show no trouble with the first ground, but would be likely to develop trouble at that ground when a distant accidental ground followed at any time upon the opposite side of the system, especially when the pressure involved in the latter case would be double the pressure acting in the permanently grounded circuit. Altogether there can be no doubt, and we think that for a long time there has been no reasonable doubt, that all low-pressure circuits which enter all buildings ought to be protected effectually for the security of life and property against crosses and lightning.

Decision Opening Chicago Parks to Automobiles.

As noted already in these pages, Mr. Harry G. Osburn, electrical engineer of the American Electric Vehicle Company, of Chicago, Ill., was arrested for running an automobile on Jackson Boulevard, Chicago, in violation of a rule passed by the South Park Commissioners excluding automobiles from the parks and boulevards under their control. A writ of habeas corpus was sued out before the Hon. John Gibbons, Judge of the Circuit Court of Cook County. W. Clyde Jones, of Ludington & Jones, appeared for the relator, and Mr. R. P. Hollett for the respondents. Judge Gibbons in his decision favoring automobiles says: The Board of South Park Commissioners, a few days ago, passed an order directing their superintendent to exclude automobiles from the parks and boulevards, under their control, and in obedience to such order the relator, who was operating an automobile on Jackson boulevard in defiance thereof, was arrested. He immediately sued out of this court a writ of habeas corpus demanding his release from arrest, on the ground that the said order is unreasonable, unconstitutional and therefore void. As it is assumed for the purpose of this case that the South Park Commissioners complied with all the usual formalties in respect to the passage of by-laws or ordinances, the question arises whether, under any form of law, it has power to exclude automobiles from the boulevards within its jurisdiction.

The South Park Board was created by special charter, passed by the Legislature of this state, in 1869, and the Commissioners are, by said act, empowered to acquire land which shall be "held, managed and controlled by them and their successors as a public park, for the recreation, health and benefit of the public, and free to all persons forever, subject to such necessary rules and regulations as shall from time to time, be adopted by said commissioners and their successors, for the well ordering and government of the same." By subsequent legislation the Board has been empowered to acquire public streets leading to parks under its control, and the Board has all the power, authority and jurisdiction over park property and boulevards, which is exercised by the common council of a municipality over the public squares and places under its jurisdiction. McCormick vs. South Park Commissioners, 150 Ill., 516. The Legislature leaves no room to question the object which it had in view in creating the Board, and enabling it to acquire, purchase and condemn property for park purposes, for it declares that the land so acquired shall be held, managed and controlled by them and their successors as a public park for recreation, health and benefit of the public, and free to all persons forever.

This case is important not only as to the power of the Board to pass the order in question, but how far it may go in permitting the parks and boulevards to be used by automobile companies for gain or profit. Our boulevards in and between our park systems have cost us millions of dollars and it would be a very convenient thing for an individual or a corporation to take possession of them, with or without the license of the Park Board and use them for carrying passengers for hire. The time may come when the commissioners will grant licenses for the use of those boulevards, but there is so much territory all around us, there are so many streets, why should not the parks and boulevards be held sacred for the objects for which they were acquired? The automobile has come to remain with us and we welcome it as a great improvement over horse cars and the ordinary street car. The time is not far distant when no horse car, trolley car or cable car will be permitted to occupy any of our business streets. They have served their purpose. They should be either above or below the surface of our streets.

The Board of Park Commissioners have no right to prohibit any vehicle, used for recreation or pleasure, from using the boulevards so long as it does not endanger the safety of others. It has no right to prohibit the automobile by name any more than the bicycle or tricycle or dogcart, but it has the right and it is its imperative duty to prohibit any vehicle whether bicycle, horse carriage or automobile, within the parks to run at a higher rate of speed than four or five miles an hour. Any higher rate of speed endangers the safety of the women and children who resort there for recreation and pleasure. The Board has the power to set apart certain drives or places where they may prohibit vehicles from going, or where they have the facility they may designate what part of the boulevard should be used by bicycles, for example, and may prohibit any other kind of vehicle from encroaching upon that territory. But where there is but one North and South boulevard the Board has not the power to prevent the fortunate owner of an automobile to use that boulevard for pleasure.

Aside from the question of passing an ordinance which is on the face of it unreasonable, the Board has almost plenary power over the parks, and it is well that it should because, as already stated, the parks are a great and growing blessing to the people.

The order in question is void in singling out automobiles by name and placing them under the ban of outlawry, when as a matter of common observation and scientific knowledge there is less danger in propelling an automobile than there is in driving a horse and buggy. The relator is discharged.

Electric Tunnel Plans for New York, New Jersey and Long Island.

Plans have been drawn for the Long Island Railroad's projected tunnel under the East River, and work will be begun as soon as a franchise is obtained from the Municipal Assembly. J. Vipond Davis, chief engineer of the Long Island Railroad, who drew the plans, will have charge of the construction of the tunnel, which will run thirty feet under the bed of the river from Maiden Lane, Manhattan, to Pineapple Street, Brooklyn. It will be 2500 feet long.

The Long Island and New York Terminal Railroad Company has been incorporated with a capital of $7,500,000. The Board of Directors comprises August Belmont, Charles M. Pratt, William H. Baldwin, Jr., Richard H. McCurdy, Levi P. Morton, Dumont Clark and other prominent men.

The underground railroad is to extend under Maiden Lane and Cortlandt Street to the North River, eighty feet below the surface, with two stations, one at Pearl Street and the other near the elevated stations in Cortlandt Street. In Brooklyn the road will run underground to a station near the City Hall and thence to the Long Island Railroad's Flatbush Avenue station.

The new company's work will be in connection with a general rapid transit scheme of the Long Island Railroad, which will remove the tracks from Brooklyn's streets, and includes subways and elevated structures to Jamaica. The tunnel will be used for passenger traffic only. The time from borough to borough will be four minutes, and trains will run to Jamaica at the rate of thirty miles an hour.

Electricity will be the motive power under the river, and the tunnel will be divided into two fifteen-feet iron tubes, each containing a single track. The Greathead system of tunneling by means of compressed air and hydraulic pressure will be used.

Articles of incorporation of the Metropolis Tunnel Railroad Company have also been filed at Albany. It is proposed to build and operate a sub-service or tunnel railroad of standard gauge five miles long, placed in one or two tunnels, operated by electricity or other power, for the transportation of passengers and freight. One of its terminals is to be in Brooklyn, near the junction of Fulton and Willoughby Streets, whence the road is to run by a convenient route through a tunnel under the East River into New York City; thence through a tunnel to a point on Broadway between Canal Street and South Ferry; thence the road is to run underground to the shore line of the Hudson River, and thence by a tunnel under the surface of the Hudson River to the middle line of the river, which shall be the western terminus in New York State. The points first and last above designated are to be the termini of the railroad in this state. It is intended further to continue the line of the railroad from the middle line of the Hudson River beneath its surface by a tunnel or tunnels to the shore line of New Jersey, and to construct a part of the road in that state to a terminus in Jersey City.

The capital stock is placed at $50,000, which amount may be increased to such sum as may be hereafter required for the construction and operation of the railroad. The capital is to consist of 500 shares of $100 each. All the stock is to be common stock. The directors are: Cromwell G. Macy, H. W. Kibbe, B. A. Finkelstein, William Abbott, George N. McCormick, John A. Foley and James Hynes, of New York, and Peter I. Hoffman, C. H. Southworth, Charles A. Cregin, Theodore A. Madden, Frank M. Orendino, Charles J. Swanholm and John Toahill, of Brooklyn.

No details are given out as to any of the technical plans proposed for adoption by the second of these corporations, and it would appear that if both schemes were carried through, their interests would come in conflict. The first plan has the advantage of direct co-operation with the Long Island Railroad and of meeting its pressing need of greater terminal facilities.

Canadian Water-Power Electrical Plants—III.

ELECTRICAL TRANSMISSION PLANT AT THREE RIVERS, QUEBEC.

By E. M. ARCHIBALD.

THE St. Lawrence is fed by numberless streams, large and small, the majority of which lie on its northern shore in the province of Quebec. The source of these streams is in the great Laurentian Mountains, famous for their geology, situated parallel to and distant some 150 miles from the St. Lawrence.

In making this great descent in such a short distance we would naturally expect to find the streams exceedingly rapid; nor are we mistaken, for so rapid and wild are they that we are almost compelled to believe that nowhere else can such hydraulic conditions exist.

Near the city of Three Rivers, Quebec, there is a small electric plant in operation obtaining power from one of these rivers, the Batiscan, which has been in uninterrupted operation since its inception, May 12, 1897, transmitting electrical power to Three Rivers, seventeen miles distant, and as such takes its place amongst our long-distance transmission plants.

The Batiscan has its source far back amongst the numerous lakes on the highlands of the Laurentian Mountains, thus providing an unfailing water supply; and after winding around mountain wilderness and dropping into peaceful valley, is finally stilled in the broad expanse of the St. Lawrence. At a point on this river known as the Grande Chute the water falls a depth of 70 feet in a distance of less than 100 yards, and on this account and also by reason of the natural advantages of the location, the situation of a power house is almost ideal.

Previous to 1897 the Corporation of Three Rivers had been doing all the incandescent and arc lighting by the use of steam engines in connection with its already existing water pumping system; but in so doing was running behind in its accounts every year, even though the charge for private lighting was at a comparatively high rate. After meeting several deficits, it was decided to dispose of the electric plant as soon as possible, and an offer made by the North Shore Power Company was favorably considered, duly approved and the transfer made, although at a considerable reduction in first cost. A contract was then made with this company for the street lighting.

The North Shore Power Company in looking around for a suitable water power in order to reduce the cost of operation, saw the advantages of and decided upon the Grande Chute on the Batiscan River near the French village St. Narcisse. Although this was seventeen miles from the city, the cost of dam, power house, equipment and transmission line was found to be comparatively small, so that by careful management a good profit could be realized.

Accordingly, this power was purchased, operations immediately commenced and on May 12, 1897, without any interruption in the lighting service, the system of Three Rivers was changed from a single-phase distribution with steam generating plant in the city, to a two-phase distribution with water power plant, seventeen miles distant.

After obtaining the water power there was one of three situations to be decided upon for the plant location: Two of them each with a head of 70 feet, and the other with only 50 feet. Strange as it may seem at first sight, the latter was chosen on account of the small cost with which a dam and power house could be erected in that location. Owing to volcanic action in ages long past, a natural dam had been formed extending the greater part of the distance across the river. This had to be extended and raised to such a height as to bring the level of the dam above the high water in spring time.

The general view of the property and power house is given in Fig. 1. In the right hand corner the dam may be seen extending towards the left, the lower part of which is the spillway over which the water, ice, logs (lumbering being a great industry) and rubbish pass, the high part being the dam proper. At the junction of the dam and the spillway there is constructed a wall of masonry at right angles to the dam, acting as a prop to aid the dam in withstanding the pressure upon it. The dam is 11 feet thick at the bottom, tapering off to 3 feet at the top, and is built of masonry, the rock all being obtained from the bottom of the present head race by blasting. This rock is similar to, but harder than, granite, and is to be found in large quantities at all the waterfalls in this neighborhood, but in no other place.

No trouble has been experienced from frazil ice, that bugbear to Canadian water power development, although the river has been full of it. The reason of this is that the frazil is all swept down by the very rapid current going over the falls, so that none enters the head race, and as this is completely frozen over all winter, frazil is out of the question, as it can only form in open rapids. This is the same plan that has been tried with success at Quebec and also at the Lachine Rapids near Montreal.

There are two head gates in the extreme end of the dam, nearest the power house, only one of which is in use at present. A rack of flat iron bars at the entrance to the head gate acts as a screen to prevent rubbish from entering the pipe. There is also a waste gate which can be opened more or less to get rid of accumulated rubbish.

PIPE LINE.

The pipe is made of 5-16 inch steel plate, 6 feet 6 inches in diameter and in 6 feet sections riveted together; the whole being embedded one-third of its depth in a rock foundation. Commencing at the head gate, into which it is securely cemented, it runs to the power house, a distance of 400 feet, in a perfectly straight line.

By being kept filled with water at all times, expansion and contraction have no great effects. A small effect, however, does exist, and this forces the turbines, which are directly connected to it, to move through a maximum distance of 3/8-inch from winter to summer. It becomes necessary then in order to preserve perfect alignment between dynamos and turbines, to shift the dynamos backwards or forwards.

At the termination of the pipe line, which passes directly under the power house, is a large head-sheet, in which is situated a 12-inch gate valve for purposes of draining the pipe when repairs become

necessary. Directly under the wheel casings, a few feet from the end, two vertical branch pipes 5 feet in diameter are connected into the pipe for supplying the water for the turbines. A relief valve is situated midway between the two turbines for disposing of the imprisoned air, which becomes compressed to such an extent during a sudden rush of water that there is otherwise danger of bursting the pipe.

The tail water is normally at a depth of 12 feet below the centre line of the turbines, and in order to keep that depth constant, an overflow weir is built under the power house over which all the tail water must flow to the tail race beyond, a natural watercourse leading to the river below.

POWER HOUSE.

Nestling in a natural gulley, seemingly prepared for it, and surrounded by rough boulders scattered about promiscuously, between which the scant vegetation struggles for its very existence, is the power house, a rough stone, one-story building, 62 feet long by 36 feet wide, having for its foundation an enormous flat granite ledge.

The interior (Fig. 2) is a great contrast to the outside surroundings, presenting a very neat, bright and cheerful appearance, the walls and roof both being painted white. Situated directly on the main floor are the two wheel cases (Fig. 3), built of 5-16-inch steel plate 6 feet in diameter and 6 feet in length, with heavy cast iron heads supported by I-beams on solid masonry. Terminating in the cast iron heads are two quarter-turn steel elbows, 2 feet 6 inches in diameter, forming the discharge pipes and at the same time providing a bearing for the turbine shaft; which passes entirely through the wheel case.

Situated in each wheel case are two 21-inch wheels on one shaft developing 200-hp each under a head of 50 feet and running at 400 r. p. m. By placing a wheel on each side, the water from the pipe line flowing between them and discharging outwards on both sides, the thrust is equalized, and a uniform twist is produced on the generator shaft, which is directly connected by means of an insulating leather coupling. This coupling consists of four links, each link containing six heavy sole leather strips bolted at each end to the turbine and generator shafts, respectively, thus permitting free operation even when out of alignment to a small degree, and also affording perfect insulation.

Situated in each branch pipe entering the wheel case is a butterfly gate operated by worm gearing for regulating the quantity of water entering the wheel; above this is a pipe with a stop-cock for completely draining the wheel case when necessary.

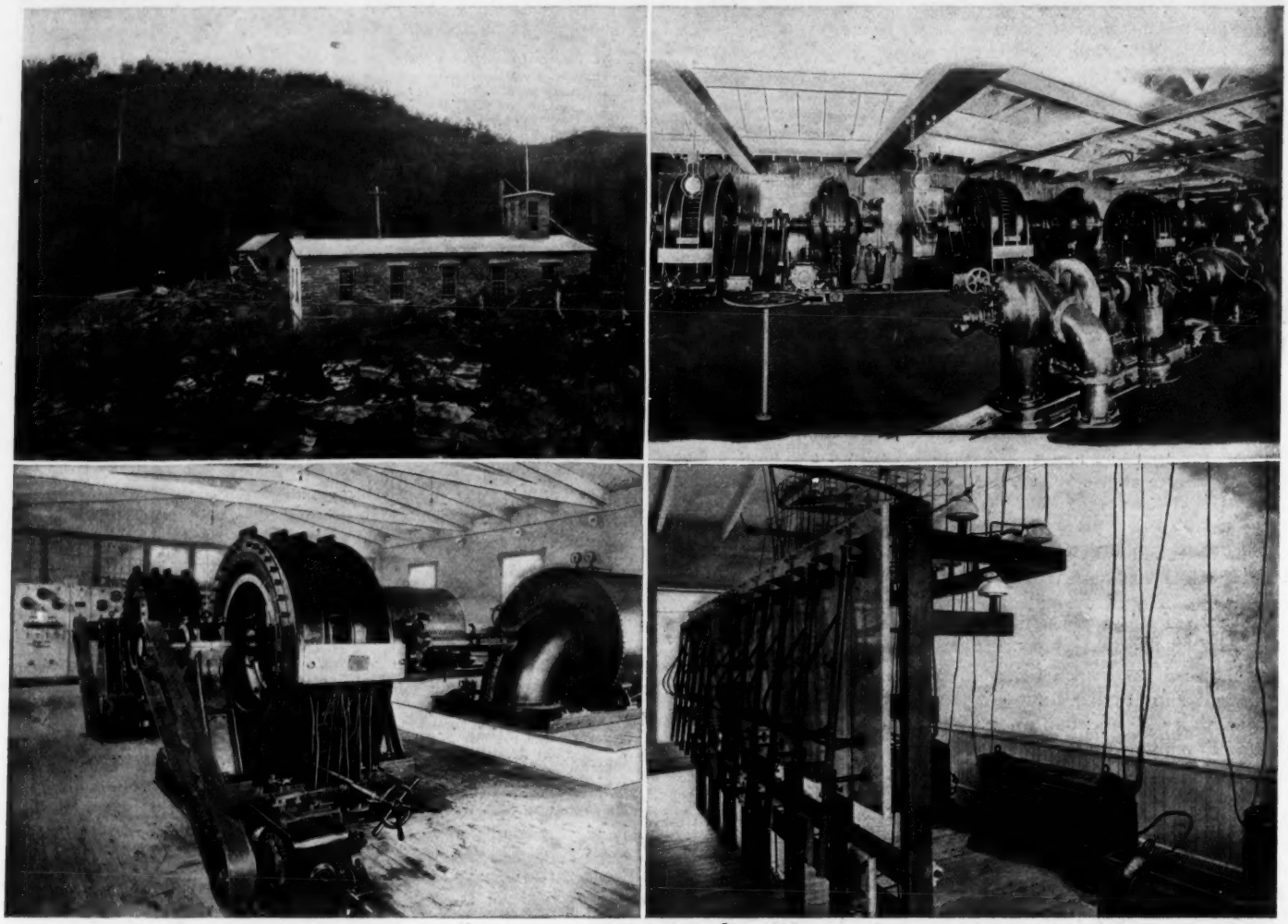
Regulation, which is all performed by hand, is also afforded by means of a worm gearing operating the guide blades, which may thus be set in any position desired.

These wheels, which are of the Crocker type, together with the steel flume, were supplied and installed by the Jenckes Machine Co., of Sherbrooke, Quebec.

The two generators, which are direct-connected to the turbines, are each of 240-kw, two-phase, S. K. C. system, supplying current at a frequency of 133 cycles per second and at a pressure of 2400 volts. This high frequency was adopted so as to change from the old single-phase system with its alternators and transformers designed for that periodicity with the least possible cost.

Belt-connected to each generator is a 4-pole, 10-kw, 50-volt Royal Electric exciter, running at 570 r. p. m., each being capable of fully exciting both generator fields. These generators are situated 15 feet apart, centre to centre, sufficient room being left for the installation of another generator of similar size.

A very neat little switchboard, consisting of three white marble panels on a hardwood frame, is used for regulating the above apparatus, and also for operating them in parallel. A portion of it may be seen in Fig. 2. The two outside panels are exactly similar, one for each machine, and contain a voltmeter and two ammeters for indicating the voltage and current on each phase, a small switch placing the voltmeter across either phase through a step-down transformer; two double-pole single-throw switches, one for each phase,



THE THREE RIVERS TRANSMISSION PLANT.

Fig. 1.—View of Power House.
Fig. 2.—Interior of Power House.
Fig. 3.—Wheel Cases in Power House.
Fig. 4.—Transformer Switchboard.

of the ordinary slide type as used in the S. K. C. system; a double-pole, double-throw horizontal switch for connecting either one of the two exciters to the generator field; and lastly, two rheostats, one for the generator field, the other for the exciter. The middle panel contains the synchronizing lamps and switch. Three lamps are used, although only one is absolutely necessary, as the machines are coupled when the lamp is bright the two outside lamps being connected constantly to their respective machines and remaining constantly bright, the middle one being the synchronizing lamp.

From this switchboard the machine terminals are carried under the

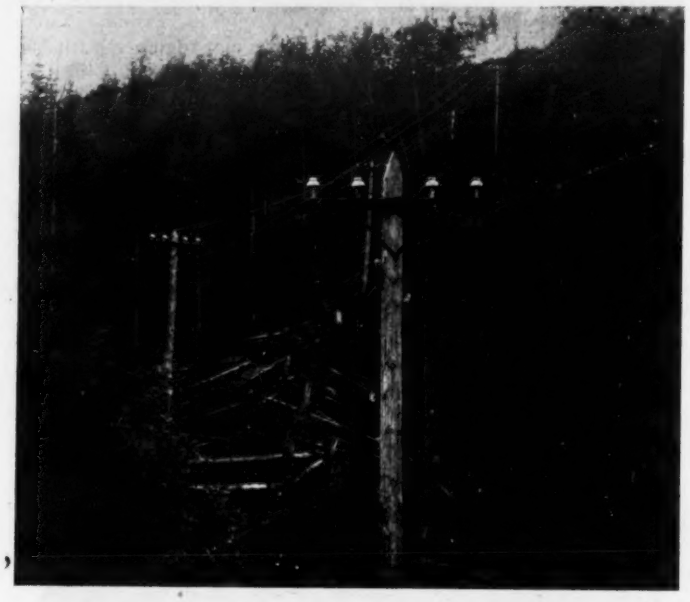


FIG. 5.—POLE LINE.

floor to the transformer board, situated at the upper end of the power house and separated from the main room by a glass partition. In this room are placed seven 60-kw Royal Electric transformers, four of them being each placed in a cylindrical iron case and air cooled by means of a draft tube, the remainder being of the ordinary type, and not used except when required by necessity. The voltage is raised from 2400 to 12,000, at which pressure it is transmitted to Three Rivers.

Both primaries and secondaries are controlled by switches on the transformer switchboard, Fig. 4, consisting of twelve panels of white marble, on each of which is placed a switch of the bayonet stick type for the primary side, and six smaller double-pole slide switches, each on separate marble slabs, for the secondaries. This switchboard has a frame of hardwood, so there is little danger from accidental contact. Its present size is for the proposed additional generator.

The centre panel contains the two static ground detectors of the Stanley type, with switch for connecting either to ground. On the back of the switchboard there are placed fuses of the D. & W. non-arcing enclosed type for protecting both the primaries and secondaries of the transformers. From this switchboard the wires pass to the line through choke coils, taps being taken off to lightning arresters of cylindrical non-arcing metal, similar to the Wurts', there being 30 gaps between each line and ground. All electrical apparatus, switchboards, instruments, etc., were manufactured and installed by the Royal Electric Co., Montreal, Quebec.

POLE LINE.

From the transformer board the four line wires pass through a cupola in the roof to the pole line, which leads directly up the side of a mountain, as seen in Fig. 5, passes through the bush, the trees being cut and burnt on each side to provide a clear path; traverses the public highway and along the Canadian Pacific Railway's right of way, crosses a bridge on cross-arms projecting from the side, and finally reaches Three Rivers, seventeen miles distant. This transmission line consists of four No. 4 bare copper wires, 18 inches apart, securely fastened to porcelain insulators of the triple-petticoat type, made by F. M. Locke, of Victor, N. Y., and tested to 45,000 volts. They are secured to the single cross-arm by 10-inch locust pins, which are extra long on account of the heavy snow and sleet which falls in this region.

The poles of white cedar 35 feet in length, 7 inches in diameter at the top are spaced 95 feet apart. For protection against lightning three barbed wires, one on top of the pole and one at each end of the cross-arm, run the entire length of the line, being grounded at every fourth pole.

A telephone line, of ordinary galvanized iron wire, is run on side brackets situated some distance below the transmission wires, and although transposed every fourth pole to prevent induction, it is present, however, to such an extent that Ericcson's anti-induction instruments had to be installed on each end of the line, the ordinary telephone instruments not operating successfully when the line was heavily loaded. The line loss is about 9 per cent. at full load, of which 2 per cent. is due to inductance.

SUBSTATION.

Reaching Three Rivers the line passes into a small transformer shed through choke coils to the switchboard, taps being taken off to lightning arresters of the Wurts non-arcing type, having 30 gaps between each line and ground. Passing through the high tension switches of the bayonet stick type, of which there are twelve, to the transformers, six in number of 60-kw each, the voltage is stepped down to 2000, the city pressure. Thence through the secondary double-pole switches to the regulator board in the substation proper, the transformers being protected on both the primary and secondary sides by D. & W. non-arcing enclosed fuses.

This substation is a brick structure formerly occupied by the corporation for its electric light plant. The present company is allowed the use of it for a certain period, the building not being included in the purchase.

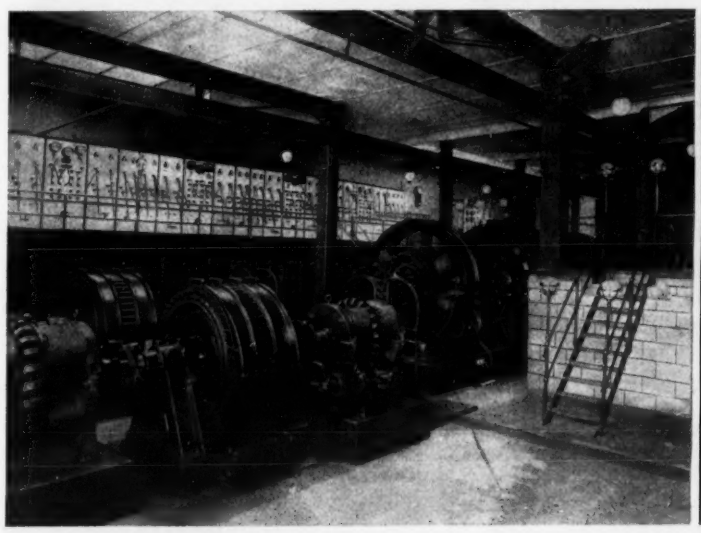


FIG. 6.—INTERIOR OF SUBSTATION.

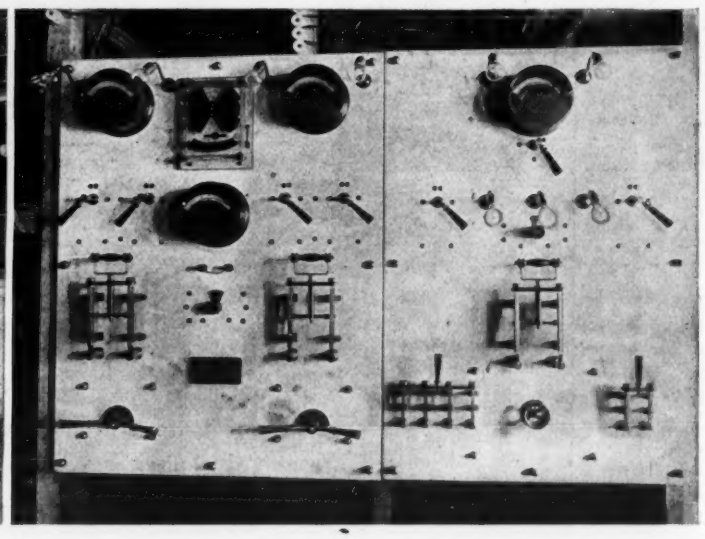


FIG. 7.—NEW SWITCHBOARD IN SUBSTATION.

The equipment consists of two T.-H. single-phase alternators with a frequency of 133 cycles per second and of 750 and 1500 lights capacity respectively; two T.-H. series arc machines of 30 and 50 lights capacity; two high-speed engines of 100 and 200-hp; two jet condensers and pumps, and four internally fired tubular boilers, all built by Leonard & Ball London, Ontario.

In the changes that have come about, the dynamos are all left in position ready to be belted directly to the engines as formerly, in case of a breakdown to the water power plant, but the 1500-light alternator has been turned into a synchronous motor taking current from one of the two phases, and drives the two arc machines for the street lights (Fig. 6). A two-phase, 1000-volt, 15-hp induction motor is used as a starter to bring the speed of the alternator up to synchronism with the generating units. Belt-connected to the countershaft is a bipolar dynamo for exciting the fields of the synchronous motor.

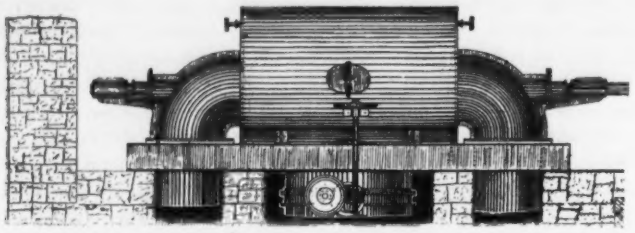


FIG. 8.—CROCKER TURBINE.

The new switchboard, Fig. 7, consists of two panels of white marble on a hardwood frame, built and installed with the rest of the electrical apparatus by the Royal Electric Company, of Montreal. The right-hand panel is for the control of the synchronous motor, the ammeter at the top indicating the amount of current consumed by the motor, under which is placed a short circuiting switch for cutting out the ammeter during operation. The ammeter is only of use in properly adjusting the field so that it takes the least amount of current. Below are the synchronizing lamps, on either side of which are situated duplex fuse blocks, so arranged that should one blow, the other may be brought into service by simply turning a switch. The double-pole main switch for the synchronous motor, the four-pole, two-phase switch for the starting motor, the field rheostat and field switch are placed on the lower part of the same panel, and may be seen in the illustration.

On the left panel are situated the two ammeters, one for each phase; static ground detector and voltmeter, each capable of being connected on either circuit by a switch placed underneath; duplex fuse blocks, one for each circuit; two main double pole switches and two transformer regulator heads. These latter vary the rate of transformation of two transformers, one in each phase, by cutting in or out more or less coils, in this manner producing the correct voltage, and hence a uniform light.

Notwithstanding the alteration from a single to a two-phase system, which was done without any interruption to the lighting service, all the old apparatus and lines are still in use, except the 750-light alternator, which is idle, so that the change was performed at a minimum cost.

The French "habitants" of Three Rivers are very conservative about changes, still clinging tenaciously to their oil lamps, so that the field covered by the incandescent lamp is not as extensive as it deserves; nevertheless, it is slowly but surely increasing. There being no motors in operation on the line, the plant is only in operation from about 5 p. m. to 5 a. m., or from sunset to sunrise.

Current is still furnished at the flat rate of $4 a year for churches, public places and residences, and $5 a year for shops for the first lamp, with a sliding scale as low as $3 a year for each additional lamp above a certain number. Some few wattmeters are, however, installed, the number of watts used being divided by the voltage, 104, to reduce to amperes, the rate being 1 cent per ampere hour. At a meeting of the directors to be held shortly, a discussion will take place as to the advisability of introducing meters altogether and charge by the kilowatt-hour.

The officers of the North Shore Power Company are: Hon. C. C. Colby, president; P. E. Panneton, vice-president, and John B. Frejeau, managing director, to whom the author is much indebted for facilities afforded.

Self-Starting Single-Phase Motor.

Hutin and Leblanc, in a patent dated July 4, describe a series-commutator alternating-current motor which, it is claimed, will work without sparking and may be given a very small self-inductance. To avoid the sparking which arises from the short-circuiting of armature coils at the commutator by the brushes, the armature winding is divided into two or more groups, and a brush employed of peculiar construction which breaks the circuit through the commutator coils gradually. The structure and connections of the machines are also modified to reduce self-induction, the method being to oppose to the m. m. f. of the inducing field-pole coils, the m. m. f. of the induced armature coils.

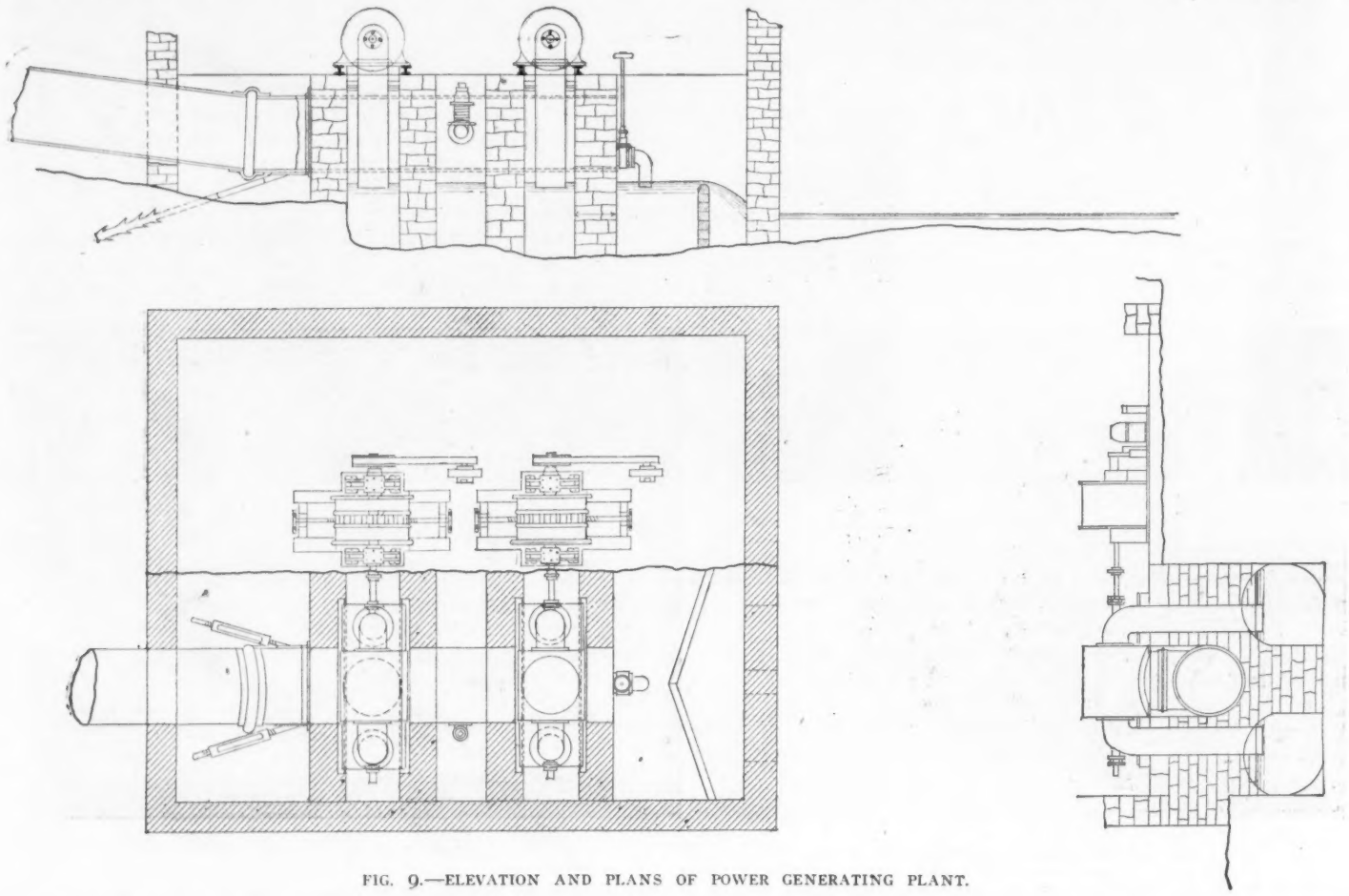


FIG. 9.—ELEVATION AND PLANS OF POWER GENERATING PLANT.

The Electrical Installation for the 1900 Paris Exposition.

BY GEORGES DARY.

THERE is evidently a close relation between the progress of electricity and the increase in space occupied by the successive expositions held in Paris the past quarter of a century. The International Exposition of 1878 occupied the Champs de Mars and the Trocadero, while that of 1889 extended over a space almost three times as large, the utilization of the quays on the left bank of the Seine permitting it to join and include the Esplanade des Invalides. In 1900 the Exposition will invade the Champs Elysees and occupy both banks of the river between the extreme limits of the exhibition grounds.

As to the part to be played by electricity, a recent report presented by MM. Potier and Hirsch to the Technical Committee of Electricity, considers this question in connection with the supply of motive power. In a preceding report it was pointed out how the electrical service and the mechanical service of the exposition were intimately connected in the production of motive power. Electricity will not only furnish the energy necessary for illumination, but will also be distributed to the most distant parts of the grounds in order to furnish motive power to run all machines in operation alongside of exhibits of manufactured products from the same, this latter feature promising to form one of the most attractive and instructive characteristics of the coming exposition. The report of MM. Potier and Hirsch proposes a number of machines of 900, 1000 and 1700-hp. The calculations in the report result in a total of 45,000-hp as necessary in steam generators, while the electrical horse-power for transmission will attain 20,000-hp alone. To compare these figures with those of previous expositions, in 1867 the motive power amounted to 350-hp; in 1878 to 2500; in1889 to 5500, of which only 2500 were actually used. For 1900, as stated before, 45,000-hp are already called for, while the electrical energy for motive power at a distance alone represents more than double the entire amount of power utilized in 1889.

FIG. 1. CHIMNEY.

Before writing in detail of the various electrical features, a glance will be taken at the building in which will be installed the electrical groups of the exposition for the production of the immense power to be radiated in all directions, and to animate the whole with a real life. These buildings—the central station—will extend to the right and left of the Chateau d'Eau, forming, so to speak, a part of the same. The readers of this journal will recall an illustration in the issue of May 13 representing the Chateau d'Eau, which structure will be the great attraction of the exposition. This will be a vast niche having an opening of 100 feet and a depth of 45 feet. In the interior sheets of water from a series of flat basins will descend in cascades to the grand central basin, and at night magnificent effects will be produced by means of the electric light.

The central station will in reality comprise two stations, 1200 feet (400 m.) long by 120 feet (40 m.) wide. One of these stations is reserved for the French electrical groups, and will be situated on Avenue de la Bourdonnais, the name of which it will take; the other, for the foreign electrical groups, will be on Avenue du Suffren, the name of which it will similarly take.

The boilers will be installed in a special room at the entrance, and the products of combustion will be conducted by enormous flues to two chimneys of monumental design, 188 feet (60 m.) high, 34 feet (18 m.) in diameter at the base, and 13½ feet (4.5 m.) at the top, which will be at the end of the respective stations. The chimney at the end of the building containing the French section is illustrated in Fig. 1. It will be built of white bricks in order that the many-colored ornaments will stand out strongly. The ornamentation will be partly in bricks of various colors, both enameled and plain, and partly in ceramic decoration.

The engines and generators will, of course, be direct-connected. Steam will be generated at a pressure of 142 pounds per square inch, which pressure may be varied 10 per cent. more or less. The electric current will be delivered to the switchboard at voltages of 125, 250 and 500 for dirct current, and 2200 for alternating current, single phase and polyphase, with a frequency of 50 periods per second. Each generator or collection of generators by the same maker will be provided with a special switchboard, and the alternating-current generators will be accompanied with transformers installed in the sub-stations of the distributing system. For the general purposes of the exposition, current will be taken direct from the switchboards.

Steam will be supplied gratuitously for running the generators, and in addition the exhibitors furnishing power will be allowed a definite amount for expenses of installation and also paid a sum proportional to the normal power and the number of hours operation of their machines. For example, the installation payment will consist, for machines under 1000-hp of $19.90 per horse-power for the steam engine and $8.16 for the dynamo; for machines of 1000 to 1500-hp, these amounts will be $14.20 and $2.50, respectively, and for larger powers $10.40 and $1.00, respectively. The total disbursement, however, may not exceed $48,000 for steam engines and $20,000 for electrical generators, of which half is allotted to the French section and half to the foreign section.

Payments for steam power will be 1.68 cents per hp-hour, for machines of the first class above mentioned; .76 cents for those of the second class and .57 cents for those of the third class. Corresponding amounts will be paid for electric power. These conditions have been approved by the Technical Committee, with, however, a reservation, owing to the smallness of the sum contributed for the expenses of this section. Indeed, if based upon the preceding figures, it will be seen that a generating set of 1500-hp, for example, would receive but $1800 for its installation, which sum represents only one-tenth of the cost for installing and removing these machines, and the same proportion applies to the cost of operation It is estimated that those supplying mechanical power will alone make a gift of about $400,000 to the exposition, this not including the deficit of those supplying electrical energy. Notwithstanding these onerous conditions, the offers already received represent more than 20,000-hp.

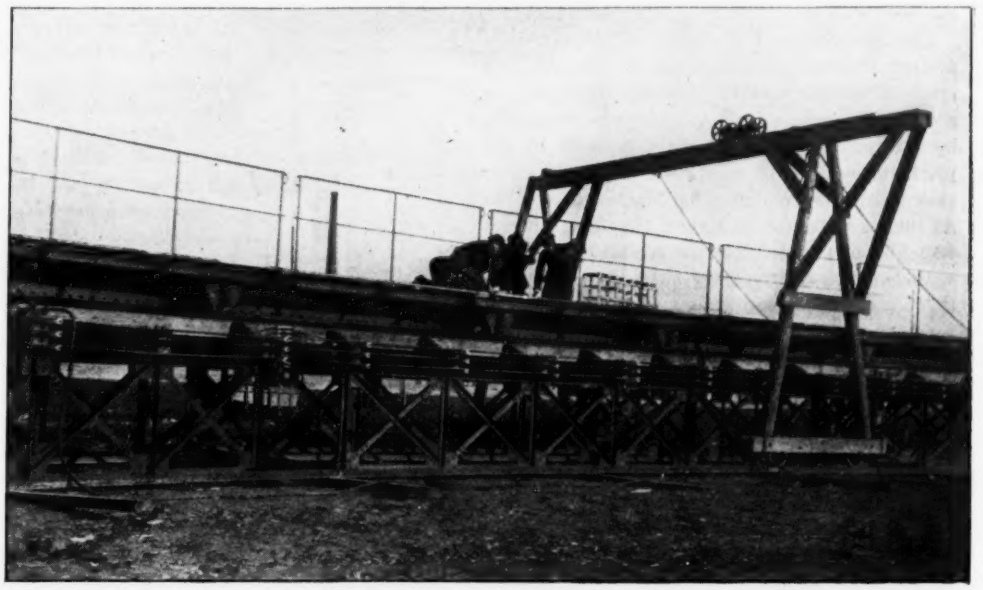


FIG. 2.—PORTION OF EXPERIMENTAL MOVABLE PLATFORM.

An extremely large quantity of current will be used by the Chateau d'Eau, for the fountain will be illuminated every evening by innumerable lamps. It may be added that the water from the fountain will be used to feed the boilers. All along the quays will be garlands of incandescent lamps, the exhibition avenues will be illuminated by arc lamps, and the buildings surmounted by projectors. The facades of the exhibition edifices will be artistically constructed with bull's-eyes in glass and transparent enamel, each containing an incandescent lamp, the principal lines of the building being brought out in colored light. This method will furnish an illumination, will diffuse the

light, thereby pleasing the eye without dazzling it. On the Eiffel tower will be suspended several thousand arc lamps arranged to bring out its outlines, and a series of commutators operated from a single point will permit variations in the lighting effect.

For means of transportation about the grounds, there will be a system of movable platforms of two speeds, such as were used at the Chicago Exposition, and which will make a complete tour of the exposition, covering a distance of about 2½ miles (4000 m.). The transportation committee required an experimental demonstration of this system, which took place at Clichy several months ago, and succeeded perfectly. A system of transportation of this kind became necessary, as the commission rejected propositions for narrow-gauge electric tramways, which had been presented by five different firms. The experience with the Decauville steam road in 1889 demonstrated the inadvisability of trams, owing to their interference with freedom of travel about the grounds, and their limited capacity. According to estimates made, the exposition of 1900 will register more than 60,000,000 visitors; that is to say, the average number will be 300,000 per day, not counting those entering on passes. It is probable that these figures will be exceeded, for in 1889 at times there were 800,000 visitors daily. Under these conditions a railway would no longer suffice, and the proposition was provisionally accepted for a movable platform at two speeds of 2½ and 5 miles per hour, respectively, with a fixed platform at one side. The route which has been definitely fixed upon for this installation is as follows: Along the Quai d'Orsay to the Champs de Mars; along the Avenue de la Bourdonnais to the Military School; then leaving the exposition grounds, the route will be along Avenue de La Motte Picquet, returning to the exposition at the Esplanade des Invalides, and then along the Rue Fabert to the Quai d'Orsay.

The movable platform will be supported on a steel structure 18 feet above the ground, and reached at the principal stations by means of a movable incline, and at intervals elsewhere by stairways. The stationary portion of the platform will be 3 feet wide (.9 m.). The slower of the two moving platforms will be 32 inches wire (.8 m.), and the faster one 5 feet (1.3 m.) wide. The latter will be supplied with benches transversely placed, each having three seats. The movement of these two platforms will be independent, so that it will be possible to stop one, if necessary, without interfering with the second.

This installation is now being laid down by the Compagnie des Transports Electriques de l'Exposition. The experiments which led to the order being placed with this company were, as stated before, made several months ago, in the presence of the Minister of Commerce and of M. Picard, Commissioner General of the Exposition. The company rented at Clichy, on the banks of the Seine, an extensive plot of ground where the trial platforms were installed (Fig. 2.) A metallic scaffolding was raised 6 feet above the ground, supporting on wooden sleepers two double lines of guiding rails. The route was of elliptical form and in development about ¼ of a mile long, with two reverse curves, being, in fact, a reduction to a scale of about one-tenth of the installation proposed for the exposition, the curves having the same radius, 150 feet. The company voluntarily decided upon the most unfavorable conditions for the trial. At the respective speeds of 2½ and 5 miles an hour, it was shown that a person could step on the moving platforms with the greatest ease. Iron railings disposed at intervals served as supports.

The platform is in sections and under each is a longitudinal beam, the lower flange of which is rounded and rests on rollers to which motion is given by motors. Each beam is connected to the beams of the forward and after platform by a flexible joint which permits passing around curves. The adherence of the beam to the friction wheels (Fig. 3) actuated by the motors, is regulated by means of a spring, the motor and gearing being mounted on a hinged frame. The weight of the truck rests entirely on the driving roller or wheel, but each section has also four guiding wheels passing over a pair of rails. The same motor drives friction rollers for both the fast and slow platforms, the diameter of one friction wheel being double that of the other, thus giving the two speeds of 2½ and 5 miles an hour. The total weight of the two platforms empty was 2000 tons.

The electrical portion of the trial installation was in the hands of M. Bernheim, engineer and director of the Société d'Application Industrielles, who decided upon the use of three-phase motors. Three-phase currents of low tension and frequency were used, that is to say, of 220 volts and 25 periods. A 150-kw 24-pole inductor generator with star winding was employed, the exciter being on the same shaft, which turned at 130 r. p. m. An overhead line of nine cables transmitted current, the total loss on the line at full load being about 6 per cent. Three cables went to the distributing switchboard, from which seven circuits of three wires each were carried to feed the different groups of motors.

One group comprised only three machines, and had in circuit a resistance and self-inductance calculated to compensate for the fourth motor. The 27 motors were connected in tension in the following manner: Group No. 1 consisted of motors 1, 8 and 15, group No. 2 of motors 2, 9, 16 and 23, and so on. This disposition was adopted that in case of derangement of a single motor consecutive motors would not have to be thrown out. Carrying a load of 60 tons the power necessary to maintain the normal speed did not exceed 55 to 56 kilowatts. The three-phase inductor motors were of the Alioth type without resistance in the rotor; with a voltage of 50 and a frequency of 25 periods, it furnished a starting torque of 12 pounds with 80 amperes. At full load (*N*, *S*, *Q*, Fig. 3) the power factor was about .8. Owing to the gearing the effort at the periphery

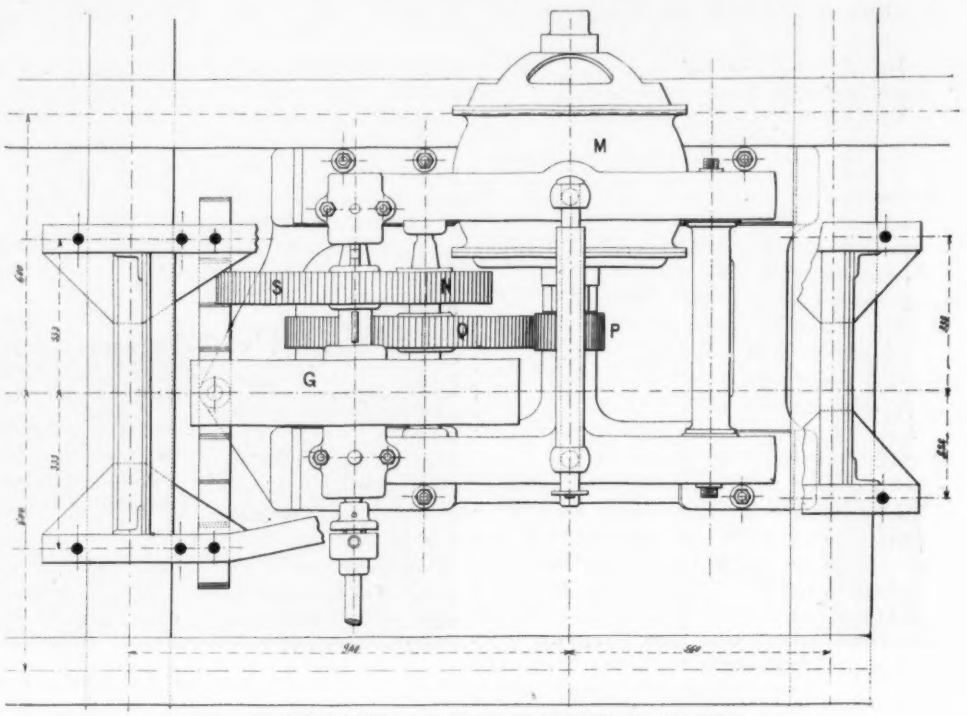


FIG. 3.—ARRANGEMENT OF MOTOR AND DRIVING MECHANISM.

of the wheel was 145 pounds. The height of the motor (Fig. 3) was 19 inches, the total width, comprising the pinion, 28 inches, and the extreme diameter, 19 inches. Trials at different speeds and without load permitted the deduction of a mean coefficient of slip equal to 1.05 for the platform at the higher speed and about 1.02 for that at the slower speed. If V represents the tangential speed of the wheels of higher speed and v the speed of the corresponding platform, V is equal to 1.05 v.

Starting up with load was obviously a delicate point, the problem being to overcome the inertia of two platforms having a dead weight in the neighborhood of 200 tons. Starting was accomplished in the following manner: The alternator was first excited at 16 amperes, and then the engine started up slowly. The current increased progressively from zero to 300 amperes, the frequency being from 5 to 6 periods. When 300 amperes were reached, the speed of the machine was suddenly increased, the current grew rapidly from 300 to 500 amperes and the voltage at the switchboard became 80 volts or 20 volts at the binding posts of the motors. At this instant, the torque of the motors was a maximum and the platform being rocked by means of levers, started slowly. The normal speed was quickly attained, when the current fell to 300 amperes, at which it was

maintained, the voltage reaching the mean value of 160 with a frequency of from 22 to 23 periods at the alternator. It will be noted that in starting it was necessary to use levers, and it is possible that with the Exposition platform some special means will have to be adopted to set it in motion. It is estimated that $1,400,000 will be required to install the platform and operate it during the 200 days of the Exhibition. As the price of passage will be 10 cents, whatever the distance, the receipts per day should be $7,000, so that it will be necessary to carry 70,000 passengers to pay expenses. The platform will be able to transport 60,000 passengers per hour and the exhibition will be open fourteen hours a day, so that counting on 300,000 visitors per day, it does not appear impossible to achieve financial success.

Electricity will not only be applied to transport visitors about the grounds of the Exposition, but the Orleans and Western railways will use electric traction for transferring passengers from the main lines to the Exposition grounds. The system adopted by the Orleans Company consists in the employment of a powerful electric locomotive weighing 45 tons and of 700-hp, the current being taken from a third rail. These locomotives will be supported on four axles, each of which will have a motor of 125-kw. It is estimated that they will haul a train of 250 tons at a speed of 30 miles an hour. The power station will be established at Ivry, and will consist of two generating sets of 1000-kw each, supplying three-phase currents at 5500 volts. There will be two rotary converter substations which will transform the three-phase currents to 550-volt direct-current for traction, and to 450 volts for lighting the cars. The change of locomotives will take place at Austerlitz station and will require a delay of less than two minutes, which will not exceed the usual stop at that station.

The Western Railway Company is at present building a large power house at Moulineaux near the Seine, for the production of current for its Invalides-Exposition-Versailles line and for the compression of air for compressed air cars, for pumping water, for lighting all its stations in the vicinity and for running elevators. The power station will have a series of generating sets composed of an engine of 1200-hp and a three-phase alternator of 800-kw and 5500 volts. Underground cables of high insulation will transport the energy for traction to three substations, for compression of air at another substation, and for lighting.

The electrical substations will each contain a battery of static transformers supplying rotary converters which will transform the high tension currents to direct-current of 550 volts. The locomotive will take current from a third rail. The distance apart of the three substations is respectively 1½ miles, 4 miles and 2 miles. In the compressed-air substation the compressors will be driven by motors, which will supply air at a pressure of 160 pounds to charge the locomotives going through tunnels under Paris. Electrically driven trains of 120 tons will run at a speed of 30 miles an hour, the maximum grade being 1 per cent., though on down grade the speed may reach 50 miles an hour. The locomotive will be supported by two trucks each having two axles mounted with motors, and the trains will be fitted with air brakes, the air pump being run by a small electric motor.

Survey for a Pacific Cable.

The British survey steamer Egeria has arrived at San Francisco from Esquimault, B. C. The English and Canadian governments are to establish a cable between British Columbia and Australia, which will touch at Samoa and Hawaii, and the Egeria is now engaged in the work of surveying the route. She will now go to Honolulu, taking soundings on the way, and after coaling there will proceed to Apia. From Apia the soundings will be taken to the nearest point on the Australian continent.

Electric Speed Indicator.

A patent was issued June 27 to August Raps, of Berlin, Germany, for an electric speed indicator of the dynamo type. The small dynamo to whose armature motion is given by the shaft to be indicated, has a saturated field supplied with current from an independent source. The indicating hand registers over the same scale for both ahead and backing, but a reversing switch in a direction-indicating circuit, supplied also with current from an independent source, causes a device in the indicator to show the words "forward" or "backward."

A Simple Form of Instantaneous Contact Maker.

By JONATHAN HARALSON, JR.

The contact maker illustrated herewith is similar in construction to the one described by Prof. R. B. Owens in the Proceedings of American Institute Electrical Engineers, Vol. XIV., page 458.

An old piece of physical apparatus was utilized in making the base and shaft. One end of the shaft was a universal joint, and to the other end was fixed a hard rubber disk. To this was attached, by means of bolts, a cast-iron ring, as shown in Fig. 1. In an opening in this ring was placed a piece of steel spring, *A*, between two pieces of fibre, *B, B*. This piece of steel spring is connected by a wire to a brass ring fitted over the hard rubber disk. A brush bearing on this brass ring is therefore in continuous connection with the steel spring *A*. Another brush bearing on the cast-iron ring makes contact with *A* once in each revolution. The angular position of this second brush is varied by shifting the arm which supports it, shown in Fig. 3, the position being indicated by a pointer under which the graduated disk attached to the arm moves.

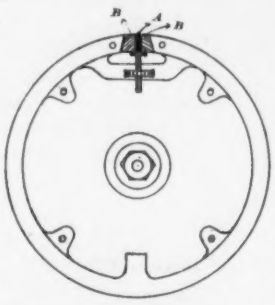


FIG. 1.—CAST-IRON RING.

To take a curve of e. m. f. with this instrument, it is attached to the end of the shaft of the machine whose curve we wish to obtain, as shown in Fig. 4. Connections are then made as shown in

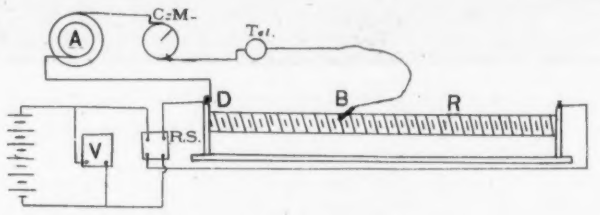


FIG. 2.—DIAGRAM OF CONNECTIONS.

Fig. 2. *C M* is the contact maker; *Tel* a telephone receiver, *R*, is a resistance consisting of 1000 turns of No. 24 German silver wire wound on a cylinder of wood 1½ in. in diameter and 50 in. long. The brush, *B*, is moved along over the resistance *R*, until the drop between *D* and *B* equals the instantaneous value of the e. m. f., when there is no knocking sound heard in the receiver.

Suppose we have a voltage of 100 volts maintained at the terminals of this resistance. Then each turn represents a drop of

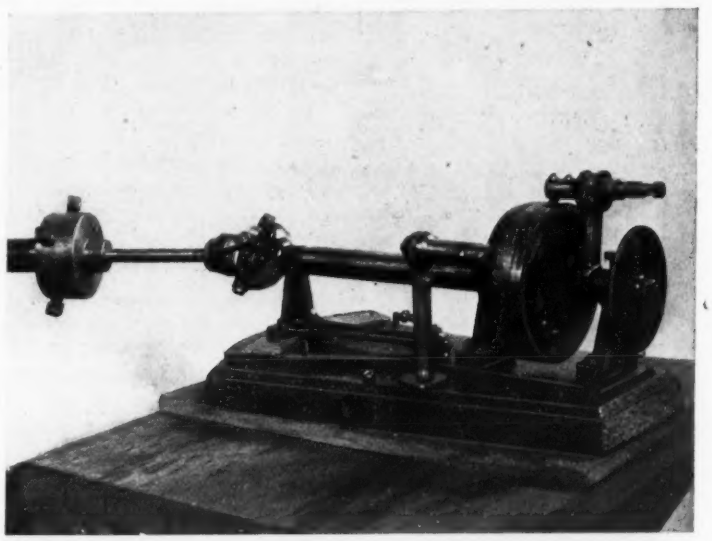


FIG. 3.—CONTACT MAKER.

one-tenth of a volt. One-tenth the number of turns from *D* to *B*, which number is indicated on a scale attached to the resistance *R*, gives the instantaneous value of the e. m. f. in volts.

The contact maker and the resistance must not be subjected to too high a voltage. Hence in measuring high voltages, the total voltage was divided up by means of several incandescent lamps placed

in series, the drop around one lamp being taken and the ratio of this to the total drop being known.

To obtain a curve of current, the drop around a non-inductive resistance, whose value is known for the effective value of the current flowing, the drop divided by the resistance gives the instantaneous value of the current.

Fig. 3 shows the contact maker, and Fig. 4 the same attached to the shaft of an alternator. Fig. 5 shows a curve of e. m. f. obtained

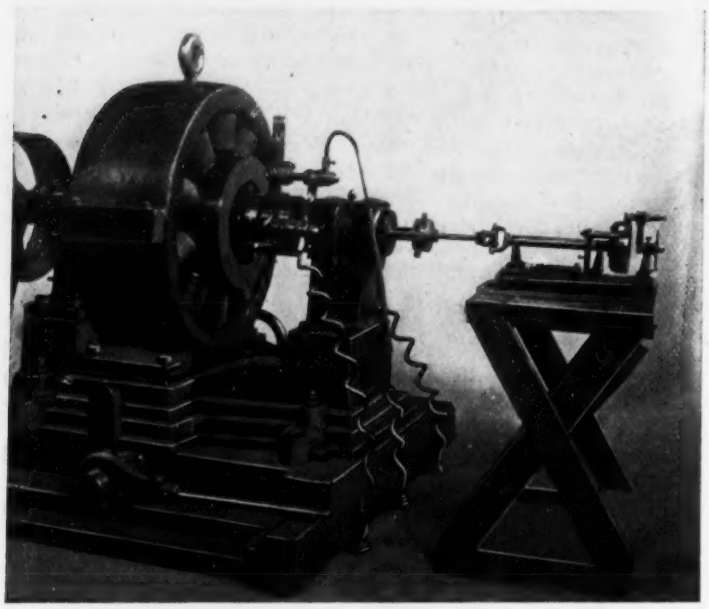


FIG. 4.—CONTACT MAKER ATTACHED TO ALTERNATOR SHAFT.

by means of this instrument and also how near it approximates a sine curve, which latter is shown dotted.

This contact maker has been in daily use in the electrical laboratory of the Alabama Polytechnic Institute and has given perfect satisfaction.

Microbes in Telephones.

A report from the Health Department Bacteriological Laboratory, bearing upon the bacterial examination of telephone transmitters in Boston which Dr. Hibbert W. Hill, director of the laboratory, has conducted, was submitted to the Board of Health last month. It shows that examinations have been made of thirteen telephones in busy public stations. In four of these there was no growth whatever,

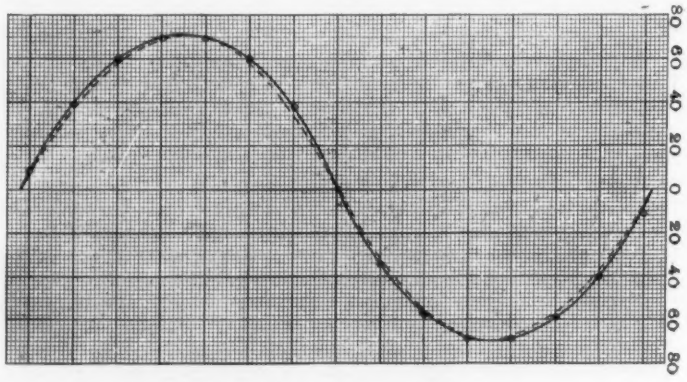


FIG. 5.—DOTTED LINE TRUE SINE CURVE.

five yielded to culture, only producing the hay bacillus from inside and out of the transmitters, a harmless and widely distributed form, very common in dust. This bacillus occurred on the outside of the transmitters in another one of the telephones, the inside showing a harmless bacillus of a different species. Still another one showed outside a short-headed bacillus, which is harmless. The inoculations of guinea pigs failed to reveal the presence of any disease-producing organism. Continuing, the report shows how it is possible, nevertheless, that infectious diseases, particularly diphtheria and tuberculosis, may be conveyed from one user of the telephone to a subsequent user, and recommends the use of a liquid disinfectant. Dr. Hill suggests further that the receiver, or ear piece of the telephone, might also be cleaned and disinfected, as that would afford some sense of security not otherwise obtainable.

Pollak-Virag Machine Telegraph System.

IN a lecture delivered before the Ingenieur und Architecten Verein of Budapest on May 13. Mr. Josef Pinter, director of the Vereinigte Electricitäts A. G., described a Pollak and Virag machine telegraph system which Messrs. Pollak and Virag had gradually evolved in the laboratory of the company which he manages. The importance of the invention lies in its extraordinary speed performance. After briefly reciting the present status of telegraphy and the numerous endeavors which have been made to develop systems giving great speed of transmission, and explaining the various systems invented since the time of Morse pointing out their respective virtues

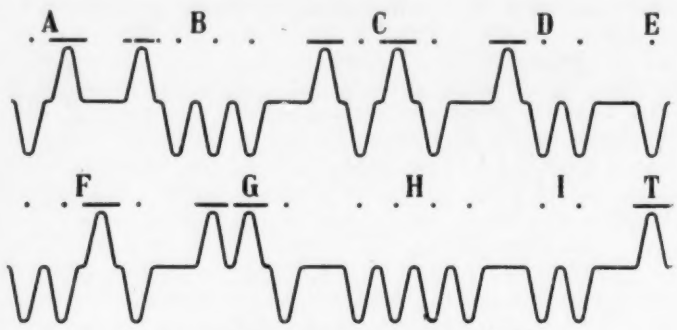


FIG. 1.—MORSE AND POLLAK CHARACTERS.

and defects, he entered upon a description of the new invention, which he claimed surpassed all existing systems.

The messages to be transmitted are first perforated on a strip of paper which passes with great rapidity under two small brushes. One brush is connected to the positive pole of one cell of battery, and the other brush to the negative pole of a second cell. The two other poles are then connected together through the return circuits. The paper slip is moved along by means of a cylinder which is connected to the circuit and makes contact with the brushes above it whenever there is a hole in the paper strip. (See Fig. 2.)

In this way positive or negative currents will be sent over the line according to which one of the brushes comes in contact with the cylinder. The paper strip has two rows of perforations, the one serving for the positive current impulses, the other for the negative ones. The one impulse produces at the receiving station a line going upward corresponding to the dash in the Morse code, while the other impulse produces downward strokes, corresponding to the dots in the Morse code, as will be seen in Fig. 1. If, therefore, the Morse code be adopted, any telegrapher can read the new signs without any effort.

The receiving apparatus is very simple. It consists of a telephone to which a small concave mirror is attached. The diaphragm is vibrated by the impulses of the current moving towards or

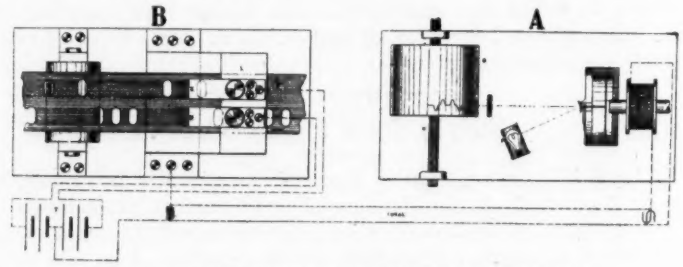


FIG. 2.—TRANSMITTING AND RECEIVING APPARATUS.

away from the electromagnet according to the direction of the impulse sent over the line. The movements of the diaphragm are transmitted to the mirror by means of a small rod. As diaphragm movements amounting to a few thousandths of a millimeter are to be dealt with, the mirror is attached in such a way that it receives comparatively large movements. The small mirror has fastened to it a small plate of soft iron by means of which it is held in position by a permanent magnet in such a manner that its one pole ending in two points holds the mirror by means of the soft iron plate, the line joining the points forming the turning axis for the movement of the mirror. The other pole of the magnet has a weak spring attached to it which also ends in a point and forms the third point of support for the mirror. This spring is connected to the diaphragm by means of a small rod, so that the small movements of the diaphragm produce a rotary movement of the small

concave mirror which are comparatively large because the points of support are very close together. The light from a small incandescent lamp falls upon the concave mirror which in turn reflects the image of the filament on to a sensitized piece of paper. This image moves out of its original position in one or the other direction, according to the movements of the diaphragm, i. e., the mirror, in consequence of the current impulses. The sensitized paper is wound on a drum, which turns on its own axis and also moves along that axis, so that the paper passes before the image in a sort of screw motion, and receives the upward and downward impressions. In this manner the successive signs on the paper will appear next to each other and can be easily read by anyone having a knowledge of the Morse system.

Two main obstacles in telegraphing still had to be removed, i. e.,

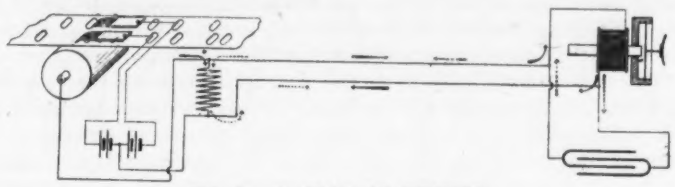


FIG. 3.—DIAGRAM OF CIRCUITS.

the momentum or swing of the diaphragm and the capacity and self-inductance of the line. The inventors have been very successful in eliminating the former owing to the fact that when the time of duration of the current impulse coincides with that of the swinging period of the diaphragm, the latter will have no swing of its own. In order to obtain this coincidence, they connect a condenser in parallel with the receiving apparatus of corresponding capacity, only send brief current impulses into the telephone, shorter than the duration of a swinging period and by the discharge of the condenser into the telephone after the current is cut off, the current impulse is considerably lengthened so that the diaphragm comes to rest, without making any extra swings. (See Fig. 3.)

The line disturbances are completely eliminated by connecting an inductance coil in parallel with the sending apparatus. The dimensions of this coil are chosen to meet the requirements. When a current impulse is sent over the line a part of it will go through the inductance coil. At the moment the current is interrupted, a current in the same direction is generated in the coil, which will, however, flow through the line in the opposite direction to that of

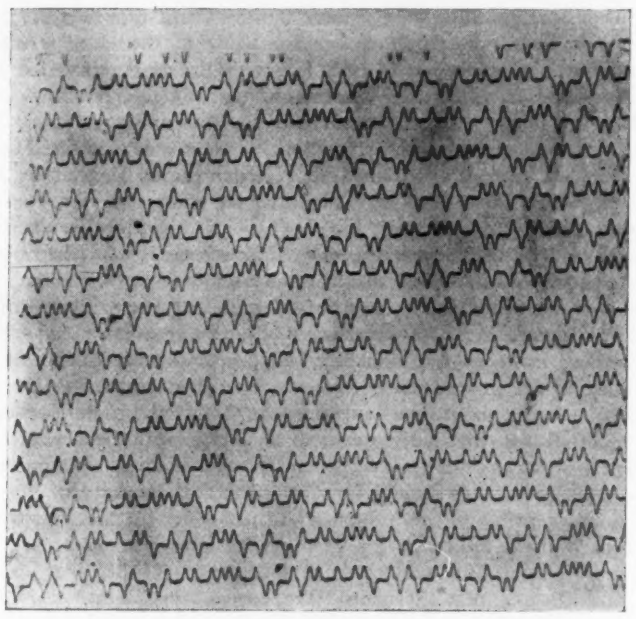


FIG. 4.—FAC-SIMILE OF MESSAGE.

the last impulse, as shown in Fig. 3, and in this way eliminate all disturbances which exist in view of the properties of the circuit.

PERFORMANCE OF THE SYSTEM.

The Royal Hungarian Chamber of Commerce has recognized the importance and value of this system and has led several of its lines into the laboratory of the Vereinigte Electricitäts A. G., of Budapest. These lines are connected at night with various circuits of the Government telegraph system, so that the experiments might be conducted more advantageously. One experiment consisted in connecting four bronze-wire circuits going to Temesvar in such a way that the current from the sending apparatus had to pass over a double line to Temesvar and from there back into the receiving apparatus, so that sender as well as receiver were in the laboratory, the current, however, having to traverse a double circuit consisting of 650 kms. of bronze wire. The resistance of the line was 4000 ohms; the signals were clear and distinct, the speed 100,000 words per hour with a working pressure of 25 volts, and the upper limit of the working capacity of the apparatus was not reached. Using a pressure of 20 volts 70,000 words could be transmitted. A fac-simile of a telegraph record is shown in Fig. 4.

Experiments over a double iron line 340 kms. in length, having a resistance of 6000 ohms enabled, in spite of the enormous inductance 54,000 words to be transmitted using a pressure of 60 volts. The experiments were not influenced by weather conditions, and the induction of neighboring wires in no way proved detrimental to the transmission. On a sheet 65 cms. long and 9 cms. wide 5000 to 6000 characters could be recorded in 22 seconds' time. The fixing and treatment necessary required an additional 2½ minutes. The perforating apparatus was already on the market, so that the inventors did not have to work on that problem.

To illustrate the capacity of this apparatus we may cite the following example: It requires 25 minutes to transmit the contents of a 16-page daily newspaper containing 40,000 words by means of this system, while an expert Hughes telegrapher requires at least 30 hours for the transmission of this message and a Morse operator could not do the work in less than five days and nights. The introduction of the new system would reduce the cost of telegraphing by the greatly increased use of the telegraph lines; in fact, it will probably reform or even revolutionize the entire telegraph industry. The demand for a simple and rapid telegraph system is felt more particularly in large cities, where the multiplication of telegraph wire becomes a more serious problem every day. The introduction of this system would decrease the number of wires required to transact the necessary business, and enable messages from a seat of war or other important points to be transmitted without interruption. By employing a sufficient number of perforating machines every possible demand on a line can be met.

Collecting Mail in Buffalo by Automobile.

Recently the United States Post Office Department authorized Postmaster Dorr, of Buffalo, N. Y., to make experiments with an automobile machine for the collection of mail in that city with a view of substituting the automobile for the horse propelled wagons. Under this authority the first attempt at mail collecting was made on Sunday evening, July 2, and it was a success. This was not only the first attempt of the kind in Buffalo, but in the United States. At 7 o'clock on the evening referred to Dr. Truman J. Martin appeared at the Buffalo post office in his "Columbia" electric buggy and took in as a passenger John D. Leib, superintendent of the city mail delivery in Buffalo. The route selected began at the county almshouse, almost at the city line on Main Street, and took in every letter box on Main Street, 40 in all, also all the larger boxes for newspapers, periodicals, etc. No collections were made on the way out. It was 8:34 o'clock when the automobile and its occupants returned to the post office, the trip having been made in less than half the time taken by a wagon drawn by a horse. It took half an hour to run to the city line on Main Street. Considering that Buffalo is a proud boaster of its miles of asphalt pavement, it sounds strange in this connection to have it stated that had it not been for the condition of the pavement, which is full of holes and positively dangerous for light weight vehicles like the automobile, the electric carriage could have been propelled much faster than it was and that the time could have been shortened on a decently paved street.

In Buffalo alone the United States government pays $10,000 a year for horse hire, much of which is for collecting mail from railroad stations and delivering it to trains, but fully $3000 of which represents collections from street boxes.

On Monday, July 3, a second experimental trip was made, the automobile leaving the post office at 9:30 a. m., and returning at 11:20 a. m., beating its own schedule by 10 minutes and covering a district seldom covered by a wagon and horse in less than three hours. Postmaster Dorr sent a favorable report to Washington.

Convention of the Canadian Electrical Association.

The Ninth Annual Convention of the Canadian Electrical Association, held at Hamilton, Ontario, June 28, 29 and 30, was a successful one in every respect, the attendance being large and the character of papers read of a high average. The large amount of time spent in considering matters affecting the more purely business interests of the members of the association curtailed the discussions of the papers read, only two—those of Messrs. Dion and Hart—being discussed at any length. The very general expression of views that these brought out, and the wide range covered compensated somewhat for the unavoidable neglect of the other papers, and served to show that the members are not lacking in interest with respect to any subject coming within the province of the electrical industry and profession. A list of the papers read, the social features of the convention and the list of officers elected were given in our issue of last week.

The convention was opened by an address of welcome by Mayor Teetzel, of Hamilton, who referred with pride to the lead which Hamilton has always taken among Canadian cities in electrical matters, which has earned it the name "The Electrical City." It was the first city in Ontario to adopt electric lighting, and there is no city on the continent east of the Mississippi River that has as large a quantity of electrical energy conveyed over as long a distance as Hamilton, which obtains its current from Niagara Falls, over thirty miles distant. In referring to the names of Canadians who have assisted in advancing the electrical art notably, his Honor included those of Edison and Alexander Graham Bell.

President Browne in his address dwelt upon the good that will result from the efforts of the association in securing the passage of a law protecting the interests of central station owners, which law will be referred to later in connection with the report of the Legislative Committee. Referring to the success of the electrical transmission from Niagara to Hamilton, he said that to-day no doubt exists as to the capability of transmitting and manipulating electricity at high voltages over long distance for the varied uses of lighting, power, electrochemistry and metallurgy, and that the question no longer is, "Can we apply electricity to this or that purpose," but, "What new fields of enterprise can it enter and develop?" The attention of the members was called to the desirability of making arrangements with manufacturers whereby current for power would only be used up to the hour when the lighting load comes on, which plan in many cases has already been applied with profit to both manufacturer and seller of electric power.

It was maintained that it would be profitable for many, if not all manufacturers, to discontinue work as soon as the dark hours begin, for the reason that the cost of manufacturing is increased during such dark hours by the expense for illumination and by the diminished productive capability of the operatives. Besides avoiding these increased expenses, manufacturers can obtain the use of electric current for power at a considerable reduction in price outside of the hours in which the greatest demand necessarily occurs for lighting. The cost of motive power to the manufacturer can be thus made much cheaper than he could otherwise produce it. This additional course of revenue or increased return upon capital investment for plant and lines will also enable the producer of electric current to sell such current for lighting profitably, at a less rate than when no revenue is derived from the plant in the day time. Less price for lighting will assist materially in the increased use of electric current for illuminating purposes. Since this idea was first suggested it has grown considerably, its application is being gradually extended, and it does not seem too much to predict that in a few years the hours of manufacturing will be restricted to the hours of daylight with all the advantages that will result therefrom. While this condition is of most value to the water power generation of electric current, it is of great value also to the steam generating plant, by reason of the increased return upon invested capital which it will provide.

President Browne strongly recommended that the association take action toward the prevention of retrograde legislation affecting the electrical interests, which recommendation later led, after lengthy discussion, to the appointment of a committee to lay and collect an assessment annually from central stations in order to provide a fund from which to draw for necessary expenses, should unfavorable legislative action threaten.

In the course of his remarks the president stated that as a result of an inquiry instituted to obtain authentic information concerning the present status of the use of acetylene for illumination, replies were received from 103 localities, and that a safe conclusion from the data thus received is that no serious menace, at least for the present, need be anticipated from this direction to the electric lighting industry, though undoubtedly useful and profitable fields will be found for the desirable and profitable use of acetylene.

The Committee on Legislation reported concerning their work in securing legislation favorable to central stations. The bill passed through their efforts provides for the transfer, upon fair conditions, of lighting plants to corporations when they decide to enter upon the business of supplying electric light. Two other important provisions are, first, a clause providing for corporations the right to get contract prices for street lighting fixed by arbitration in failure of agreement, thus removing the complaint that lighting companies could make municipalities pay an unreasonable price because of there being no competition; and second, a clause making provision for having prices charged citizens fixed in the same manner.

The report of the committee was received with much favor by the convention. It was pointed out that as all corporations dealing with the public are subject to various and unfair claims and demands, the principle of arbitration thus introduced will put matters in dispute on a basis fair to all parties concerned. The stability of the electric lighting industry is assured by the act passed, which will not only result in good to the industry itself, but also place the business on a basis that will result in more favorable terms to the public.

A committee having in charge the matter of obtaining the adoption by the Fire Underwriters of a system of electrical inspection reported that the understanding had been reached. The Underwriters took the position that they had provided rules for electrical installations and they considered that the electric companies and the municipalities should in their own interest see them carried out. The specific reason given in support of this position was that the fire hazard due to electric wiring was so small as not to warrant the expense. In the discussion the consensus of opinion was that it is desirable to have an inspection independent of that of the central station, and that, therefore, on the absence of underwriters' inspection, municipalities should be encouraged to take the matter in their hands.

A resolution was presented by Mr. Hegman, of Ottawa, for adoption by the convention, defining the candle power of the arc lamp in terms of the watts consumed. The definition was similar to that adopted by the National Electric Light Convention at Washington in 1894—that what is known as a 2000-cp open arc lamp is one requiring on the average four hundred and fifty watts for its maintenance, the measurements being made at the lamp terminals if no sensible resistance is included with the arc, otherwise such resistance to be excluded. The resolution was referred to a committee for report at the next annual convention.

In answer to a question as to capacity phenomena on the Hamilton-Niagara transmission line, Mr. Leyden stated that at no load the voltage at Hamilton was about 10 per cent. greater than at Niagara, and that even with 1000-hp on each leg there was a slight rise in voltage at the receiving end. The excess is decreased by the introduction of an inductive load, such as motors and transformers. The capacity of the line causes considerable current to flow into the line at Niagara even at no load.

A query from the question box led to a discussion of the subject "Where is the proper place to begin charging customers for wiring—at the property line or inside the building? The consensus of opinion was that only primary wiring should be charged for Against a suggestion to charge for the transformer and meter, it was urged that these should be retained as the property of the central station owing to the influence of the former on the distributing system, and the necessity for keeping the latter in repair, accurate as to indication and subject to replacement by other instruments. It was admitted that this would involve responsibility for damage, and unless legal precautions were taken, seizure of the meter for debt when property is levied upon.

A discussion also followed from the query, "Should rent be charged for meters, and if so, what would be a reasonable rate?" Mr. J. J. Wright, of Toronto, said his company charged rent on all watt-meters, at the rate of 25 cents per month for the smaller ones, and 50 cents for the larger. These rates are required owing to the cost of repairs, and the Government fee of $2.00 for testing comes out of the fund. Mr. Anderson, of Windsor, said his company makes a charge of 25 cents per month, only in the cases where the monthly bill is less than $5.00, no rent being imposed when the meter reg-

isters a larger income. Mr. Leyden stated that in Hamilton the meter rental is usually fixed at 20 per cent. annually of the cost of the meter, which includes 6 per cent. on its cost, 10 per cent. for depreciation and 4 per cent. for inspection and incidentals. Mr. A. A. Wright said that the Renfrew company charged a rental of 25 cents per month.

During the second day of the convention a discussion arose on the subject of day power loads, which had been brought forward in the president's address. Mr. Leonard, of the Dominion Cotton Mills Company, of Montreal, said his company had entered into a contract with the Royal Electric Company covering 3000-hp for power purposes, whereby power is only used during such hours as it would not ordinarily be required for lighting. In summer his company has the right to use power until 7 p. m., and in the winter months is obliged to shut down the power at 4 p. m., which accommodates the lighting station to such an extent that it can utilize the same apparatus, lines and general equipment for power purposes in the day time, and for lighting purposes in the evening. He states it as a fact that very little work is done in a shop after the lights are lit, and this of inferior quality. Mr. Leyden said that in Hamilton many contracts for power had been made under the same conditions, except that in winter the time is extended to 5 p. m. He has found comparatively little difficulty in persuading manufacturers to accept this method of buying power, though many objected until they had explained to them the advantages to both sides and the cheaper rate for power that results. Mr. Gossler stated that by this means the day load at Montreal was last winter brought up to 75 per cent. of the highest peak load, and that at present the day peak load is very considerably beyond the peak load at night, which will also be true next winter. President Browne referred to a contract where in the case of 450-hp, the privilege was given of using that amount during 20 hours per day, and 300-hp during the hours of lighting load, a very much lower rate being given per hp in consequence of this proviso. In answer to a query, the information was given that a reduction of 25 per cent. to 33⅓ per cent. could be given for power taken only during hours of small lighting load.

The paper by Mr. Dion on "Meter Rates" was followed by a discussion extending over a considerable portion of two days. Mr. Gossler, of Montreal, criticised a statement that in testing, meters should be tested in series, a rheostat or choking coil being used to adjust the voltage; such a test would, he said, be faulty for the reason that the coils introduced into circuit an inductance, which would cause the meters to read too high. In reply Mr. Dion said that when testing meters in series a master meter is used, which is first carefully tested at all loads and then used as a standard; as therefore the standard and other meters are affected alike, the presence of an inductance does not matter. Mr. Gossler rejoined that he nevertheless thought the method incorrect. Mr. Browne said his company had quite a number of meters which were made some years ago, and which ran slow under light loads; this was corrected by winding so as to work with the field, part of the shunt which acts in series with the armature. By this method a meter even with a dirty commutator can be made to register accurately without cleaning. Mr. Fisk, of Peterboro, said that he puts as much as 100 ohms of No. 30 wire on the fields, which adds to the resistance in series with the armature and eliminates the effect of friction. Mr. T. R. Rosebrugh, of Toronto, suggested that a small machine having six collector rings, giving three and six-phase current might be used to investigate the behavior of meters under inductive loads. In this way phase could be obtained 15 degs. apart all around the circle, and by a suitable combination of a non-inductive load, the 15 degree phase could be subdivided, thus giving any desired difference of phase.

Mr. Gossler said that in Montreal testing meters for three-quarters load was found most equitable to both consumer and the company. Mr. Dion said that he tests at half-load. On the matter of house testing of meters, opinions were expressed that it was impracticable, though often desirable in investigating complaints. Mr. Browne said the charges of his company were based on a fixed sum per month for the first hour per lamp per day, plus a meter rate for excess of this rate of using. Thus in the case of 25 lamps and a meter reading of 1000 lamp hours, a fixed sum would be charged for 750 lamp hours, and a low meter rate for the remaining 250 lamp hours. Mr. J. J. Wright said that in Toronto a discount of 40 per cent. was allowed for commercial, and a discount of 60 per cent. for residence, lighting, the latter extending over more hours. Such flat rate customers as are left have their consumption checked by meters, and if their business is unprofitable, they are dropped off. Mr. Henderson said that at Hamilton the two-rate system is a great success. The greater part of the discussion following the reading of Mr. Dion's paper related to the procedure in case of disputes with customers concerning the accuracy of their meters, and methods of recording meter readings and collecting accounts.

The paper of Mr. Hart on "Costs" was followed by a discussion as to the advisability of a standard system of accounting for adoption by Canadian central stations, which resulted in the appointment of a committee for that purpose.

Meeting of the Southern Independent Telephone Association.

The Southern Telephone Association met in the Peabody Hotel, Memphis, Tenn., on July 4, and was called to order at 11 a. m. by President James D. Randall. The committee on credentials reported the following present: Capt. James D. Randall, president, Memphis; George W. Scheuing, treasurer, Memphis; George W. Bolton of the Alabama, Mississippi & Tennessee Telephone Company, secretary, Pontotoc, Miss.; J. W. Burwell, of Holmes and Yazoo County Telephone Company, Ebenezer, Miss.; S. J. White, Kosciusko Telephone Company, Kosciusko, Miss.; James A. Myles, Tennessee and Arkansas Telephone Company, Memphis; W. L. Jordan, Lexington Improvement Company, Lexington, Miss.; L. B. Camp, Amory and Tupelo Telephone Company, Amory, Miss.; E. L. Mosby, Holly Springs Telephone Company, Holly Springs, Miss.; Eugene L. Collier, Paragould Telephone Company, Paragould, Ark.; A. B. Dean, Holly Springs and Victoria Telephone Company, Victoria, Miss.

The Maltese Cross was adopted as the sign of the association. A constitution and by-laws were adopted. Each member was urged to use his best efforts to secure the extension and connection of all the independent telephone companies in the neighborhood of his line and get such lines connected.

The following resolutions were adopted:

"Resolved, That this association views with gratitude the rapid and substantial growth of the independent telephone business South and throughout the country; that the business has increased to such an extent that it is now no longer an experiment, but has assumed the importance and security of one of our most conservative and solid public enterprises."

The name of the association was changed to "The Southern Independent Telephone Association." The following officers were re-elected: Capt. James D. Randall, president, Memphis; Geo. W. Scheuing, treasurer, Memphis; G. W. Bolton, secretary, Pontotoc, Miss. A vote of thanks was tendered to Capt. Randall for the zeal shown as president in the association.

During the session of the second day, Col. T. D. Young was elected an honorary member of the association. A committee, consisting of Capt. James D. Randall, T. D. Young and George W. Scheuing, was appointed to make arrangements for the independent telephone companies to enter Memphis.

It was ordered that the proceedings of the meeting, including the constitution, be printed in pamphlet form and sent to the members of the association. There was a fair attendance during the meeting of the association, and a number of letters were received from independent telephone companies regretting their inability to be present, but expressing their hearty co-operation and asking that their names be enrolled as members.

The president and secretary of the association were authorized to enroll all eligible applicants between now and the next meeting of the association. Information received during the meeting showed, it was stated, that there are a great many independent telephone lines and exchanges in the South. In Mississippi alone there are now twenty-five good independent telephone exchanges, and several more soon to be completed. The prospect now looks bright to connect all these lines and exchanges through the Southern Independent Telephone Association and feed them into Memphis and other large cities through trunk lines built for that purpose. The independent telephone companies are being induced to build better lines and put in only good telephones, and as fast as practicable extend and connect all of the independent telephone lines.

The association adjourned to meet in Memphis on the day after Mardi Gras next spring.

Electrical Standardization—II.*

EFFICIENCY.

The "efficiency" of an apparatus is the ratio of its net power output to its gross power input.**

Electric power should be measured at the terminals of the apparatus.

In determining the efficiency of alternating current apparatus, the electric power should be measured when the current is in phase with the e. m. f., unless otherwise specified, except when a definite phase difference is inherent in apparatus, as in induction motors, etc.

Mechanical power in machines should be measured at the pulley, gearing, coupling, etc., thus excluding the loss of power in said pulley, gearing or coupling, but including the bearing friction and windage. The magnitude of bearing friction and windage may be considered as independent of the load. The loss of power in the belt and the increase of bearing friction due to belt tension, should be excluded. Where, however, a machine is mounted upon the shaft of a prime mover, in such a manner that it cannot be separated therefrom, the frictional losses in bearings and in windage, which ought, by definition, to be included in determining the efficiency, should be excluded, owing to the practical impossibility of determining them satisfactorily. The brush friction, however, should be included. Where a machine has auxiliary apparatus, such as an exciter, the power lost in the auxiliary apparatus should not be charged to the machine but to the plant consisting of machine and auxiliary apparatus taken together. The plant efficiency in such cases should be distinguished from the machine efficiency.

The efficiency may be determined by measuring all the losses individually and adding their sum to the output to derive the input, or subtracting their sum from the input to derive the output. All losses should be measured at, or reduced to, the temperature assumed in continuous operation, or in operation under conditions specified. (See rules on Rise of Temperature, following.)

In order to consider the application of the foregoing rules to various machines in general use, the latter may be conveniently divided into classes as follows:

I. COMMUTATING MACHINES.

In commutating machines the losses are:

a. Bearing friction and windage, as above noted.

b. Molecular magnetic friction, and eddy currents in iron and copper. These losses should be determined with the machine on open circuit, and at a voltage equal to the rated voltage + I r in a generator, and — I r in a motor, where I denotes the current strength, and r denotes the internal resistance of the machine. They should be measured at the correct speed and voltage, since they do not usually vary in proportion to the speed or to any definite power of the voltage.

c. Armature resistance losses, I^2r', where I is the current strength in the armature, and r′ is the resistance between armature brushes, excluding the resistance of brushes and brush contacts.

d. Commutator brush friction.

e. Commutator brush-contact resistance. It is desirable to point out that with carbon brushes the losses (d) and (e) are usually considerable in low-voltage machines.

f. Field excitation. With separately excited fields, the loss of power in the resistance of the field coils alone should be considered. With shunt fields or series fields, however, the loss of power in the accompanying rheostat should also be included, the said rheostat being considered as an essential part of the machine, and not as separate auxiliary apparatus.

(b) and (c) are losses in the armature or "armature losses;" (d) and (e) "commutator losses;" (f) "field losses."

The difference between the total losses under load and the sum of the losses above specified, should be considered as "load losses," and are usually trivial in commutating machines of small field distortion. When the field distortion is large, as is shown by the necessity for shifting the brushes between no load and full load, or with variations of load, these load losses may be considerable, and should be taken into account. In this case the efficiency may be determined either by input and output measurements, or the load losses may be estimated by the method of section II.

*Report of the Institute Committee on Standardization of Generators, Motors and Transformers.

**An exception should be noted in the case of storage batteries or apparatus for storing energy, in which the efficiency, unless otherwise qualified, should be understood as the ratio of the energy output to the energy intake in a normal cycle.

Boosters should be considered and treated like other direct-current machines in regard to losses.

In motor generators, dynamotors or converters, the efficiency is

$$\frac{\text{the electric output}}{\text{electric input.}}$$

II. SYNCHRONOUS MACHINES.

In synchronous machines the output or input should be measured with the current in phase with the terminal e. m. f., except when otherwise expressly specified, owing to the uncertainty necessarily involved in the approximation of load losses, it is preferable, whenever possible, to determine the efficiency of synchronous machines by input and output tests.

The losses in synchronous machines are:

a. Bearing friction and windage, as above noted.

b. Molecular magnetic friction and eddy currents in iron, copper and other metallic parts. These losses should be determined at open circuit of the machine at the rated speed and at the rated voltage, + I r in a synchronous generator, — I r in a synchronous motor, where I = current in armature, r = armature resistance. It is undesirable to compute these losses from observations made at other speeds or voltages.

These losses may be determined either by driving the machine by a motor, or by running it as a synchronous motor, and adjusting its field so as to get minimum current input and measuring the input by wattmeter. The former is the preferable method, and in polyphase machines the latter method is liable to give erroneous results in consequence of unequal distribution of currents in the different circuits caused by inequalities of the impedance of connecting leads, etc.

c. Armature resistance loss, which may be expressed by $p\ I^2\ r$; where r = resistance of one armature circuit or branch, I = the current in such armature circuit or branch, and p = the number of armature circuits or branches.

d. Load losses as defined in section 7. While these losses cannot well be determined individually, they may be considerable and, therefore, their joint influence should be determined by observation. This can be done by operating the machine on short circuit and at full-load current, that is, by determining what may be called the "short-circuit core loss." With the low field intensity and great lag of current existing in this case, the load losses are usually greatly exaggerated.

One-third of the short-circuit core loss may, as an approximation, and in the absence of more accurate information, be assumed as the load loss.

e. Collector-ring friction and contact resistance. These are generally negligible, except in machines of extremely low voltage.

f. Field excitation. In separately-excited machines, the I^2 r of the field coils proper should be used. In self-exciting machines, however, the loss in the field rheostat should be included, as above noted.

III. SYNCHRONOUS COMMUTATING MACHINES.

In synchronous converters, the power on the alternating current side is to be measured with the current in phase with the terminal e. m. f., unless otherwise specified.

In double current generators, the efficiency of the machine should be determined as a direct-current generator, and as an alternating current generator, as above noted. The two values of efficiency may be different, and should be clearly distinguished.

In synchronous converters the losses should be determined when driving the machine by a motor. These losses are:

a. Bearing friction and windage, as above noted.

b. Molecular magnetic friction and eddy currents in iron, copper and metallic parts. These losses should be determined at open circuit and at the rated terminal voltage, no allowance being made for the armature resistance, since the alternating and the direct currents flow in opposite directions.

c. Armature resistance. The loss in the armature is $q\ I^2\ r$, where I = direct-current in armature, r = armature resistance and q, a factor which is equal to 1.37 in single-phasers, 0.56 in three-phasers, 0.37 in quarter-phasers and 0.26 in six-phasers.

d. Load losses. The load losses should be determined as above noted, with reference to the direct-current side.

e and f. Losses in commutator and collector friction and brush-contact resistance, as above noted.

g. Field excitation. In separately-excited fields, the I^2 r loss in the field coils proper should be taken, while in shunt and series fields

the rheostat loss should be included, except where fields and rheostats are intentionally modified to produce effects outside of the conversion of electric power, as for producing phase displacement for voltage control. In this case 25 per cent. of the I^2 r loss in the field proper at non-inductive alternating circuit should be added as proper estimated allowance for normal rheostat losses, as above noted.

Where two similar synchronous machines are available, their efficiency can be determined by operating one machine as a converter from direct to alternating, and the other as a converter from alternating to direct, connecting the alternating sides together, and measuring the difference between the direct-current input, and the direct-current output. This process may be modified by returning the output of the second machine through two boosters into the first machine and measuring the losses. Another modification might be to supply the losses by an alternator between the two machines, using potential regulators.

IV. RECTIFYING MACHINES OR PULSATING-CURRENT GENERATORS.

These include: Open-coil arc machines, constant-current rectifiers.

The losses in open-coil arc machines are essentially the same as in sections 6 to 9 (closed-coil commutating machines). In alternating current rectifiers, however, the output must be measured by wattmeter and not by voltmeter and ammeter, since owing to the pulsation of current and e. m. f., a considerable discrepancy may exist between watts and volt-amperes, amounting to as much as 10 or 15 per cent.

In constant-current rectifiers, transforming from constant-potential alternating to constant direct-current by means of constant current transformers and rectifying commutators, the losses in the transformers are to be included in the efficiency and have to be measured when operating the rectifier, since in this case the losses are generally greater than when feeding an alternating secondary circuit. In constant current transformers the load losses are usually larger than in constant-potential transformers and thus should not be neglected.

The most satisfactory method of determining the efficiency in rectifiers is to measure electric input and electric output by wattmeter. The input is usually not non-inductive, owing to a considerable phase displacement and to wave distortion. For this reason the apparent efficiency should also be considered, since it is usually much lower than the true efficiency. The power consumed by the synchronous motor or other source driving the rectifier should be included in the electric input.

V. STATIONARY INDUCTION APPARATUS.

Since the efficiency of induction apparatus depends upon the wave shape of e. m. f., it should be referred to a sine wave of e. m. f., except where expressly specified otherwise. The efficiency should be measured with non-inductive load, and at rated frequency, except where expressly specified otherwise. The losses are:

a. Molecular magnetic friction and eddy currents measured at open circuit and at rated voltage — Ir, where I = rated current, r — resistance of primary circuit.

b. Resistance losses, the sum of the I^2 r of primary and of secondary in a transformer, or of the two sections of the coil in the compensator or auto-transformer, where I = current in the coil or section of coil, r = resistance.

c. Load losses, i. e., eddy currents in the iron and especially in the copper conductors, caused by the current. They should be measured by short-circuiting the secondary of the transformer and impressing upon the primary an e. m. f. sufficient to send full-load current through the transformer. The loss in the transformer under these conditions measured by wattmeter gives the load losses + I^2 r losses in both primary and secondary coils.

d. Losses due to the methods of cooling, as power consumed by the blower in air-blast transformers, and power consumed by the motor driving pumps in oil or water cooled transformers. Where the same cooling apparatus supplies a number of transformers or is installed to supply future additions, allowance should be made therefor.

In potential regulators the efficiency should be taken at the maximum voltage for which the apparatus is designed, and with non-inductive load, unless otherwise specified.

VI. ROTARY INDUCTION APPARATUS.

Owing to the existence of load losses and since the magnetic density in the induction motor under load changes in a complex manner, the efficiency should be determined by measuring the electric input by wattmeter and the mechanical output at the pulley, gear, coupling, etc.

The efficiency should be detemined at the frequency and the input measured with sine waves of impressed e. m. f.

The efficiency may be calculated from the apparent input, the power factor and the power output. The same applies to induction generators. Since phase displacement is inherent in induction machines, their apparent efficiency is also important.

In frequency changers, i. e., apparatus transforming from a polyphase system to an alternating system of different frequency, with or without a change in the number of phases, and phase converters; i. e., apparatus converting from an alternating system, usually single phase, to another alternating system, usually polyphase, of the same frequency, the efficiency should also be determined by measuring both output and input.

VII. TRANSMISSION LINES.

The efficiency of transmission lines should be measured with non-inductive load at the receiving end, with the rated receiving pressure and frequency, also with sinusoidal impressed e. m. f.'s, except where expressly specified otherwise, and with the exclusion of transformers or other apparatus at the ends of the line.

The Brooklyn Electrical Supply System for Lighting and Power—III.*

(Concluded.)

The question of mechanical covering for the cable itself depends upon the nature of insulation, the liability to electrolytic action or the effect of gases. Paper cables must necessarily be covered by lead or other moisture-proof material, the life of the cable depending upon such moisture-proof covering. Rubber cables, when subject to electrolysis, can be protected by a covering of waterproof asbestos surrounded by a very heavy braided covering, put tight and thoroughly saturated with compound. In Brooklyn all cables, whether rubber or paper insulation, are covered wherever they pass through manholes, with heavy asbestos tape. In case a burn-out occurs on a cable with one or two thousand kilowatts behind it, such an arc and heat is developed that injury is apt to result to adjacent cables, and it was found that by protecting each cable in this way such damage has been prevented.

The design and equipment of a substation in a polyphase system depends almost entirely upon local conditions, as the substation contains merely whatever transforming apparatus is necessary to reproduce the energy in the form desired for distribution suited to the local conditions. These transforming devices are commonly as follows:

1st. Static converters and rotary transformers for transformation of polyphase into low tension direct-current.

2d. Synchronous or induction motors directly connected to arc machines or constant current transformers, with rectifying commutator for converting polyphase energy into continuous series arc current.

3d. Frequency, phase and voltage changer, when it is desired to change the frequency, phase and voltage, and the transmission current for distribution.

4th. Constant current transformers, when it is desired to regulate the polyphase transmission current for use in series alternating arc service.

As the efficiencies of these different transformer devices would, no doubt, prove interesting the following data have been collected from the daily records of the Brooklyn system:

1st. Three 150-kilowatt static converters and two 200-kilowatt rotary transformers, when taken together at three-quarter load, and measuring (by wattmeters) the high tension multiphase energy entering the static converter, and the direct-current, low tension energy (by wattmeters) leaving the rotary transformer, show an "everyday" efficiency of eighty-four per cent.

2d. The following is the measured efficient of an entire substation composed of synchronous motors driving arc machines to a capacity of about 1200 high tension series arcs:

Total polyphase energy entering the station (by wattmeters) during night run	5779 kw-h.
Series arc energy leaving the station during night run	4290 "
Commercial efficiency of substation	74.3 per cent.
Power-factor	98.2 "

*Abstract of a paper read by Mr. W. S. Barstow at the recent convention of the National Electric Light Association.

With all machines fully loaded, an efficiency of seventy-six per cent. is reached.

3d. The frequency, phase and voltage changer, measuring the polyphase energy input and polyphase energy output, at three-quarter load, shows an efficiency of eighty-six per cent.

4th. The constant current transformer at full load possesses an efficiency a little under that of the regular static type. At half load the efficiency becomes quite low. Owing, however, to the fact that in installations of any size it is always possible to secure about three-quarter load, the efficiency in actual practice is about eighty-eight per cent.

The average line loss in Brooklyn from the power station to the substations amounts to two per cent., and taking the total energy generated and distributed from the bus-bars in the Union station or generator station and that delivered by the bus-bars in the substations to the distributing system, the loss is twenty per cent., showing an efficiency of the entire system, including loss in transmission and conversion under the different forms of current, of eighty per cent. This does not include the loss on the distributing system from the substation to the customers. These are ordinary operating figures, and are somewhat higher than would be naturally expected, the good results being no doubt due to the high efficiency of the large static transformers (ninety-seven per cent.) at full load as well as that of the large synchronous motors, and the fact that the operation is so arranged that no transforming apparatus runs at less than three-quarter load and averages nearer full load.

The local polyphase transmission system is, in itself, a promoter of consolidations, as well as an economist in energy production. Besides making itself felt in the "everyday" commercial world, it is forcing upon the manufacturing industries new developments in steam and electrical machinery. At the time of the completion of the Brooklyn system, some eighteen months ago, a single unit, generating steadily 2000 kilowatts during each hour of the day, was somewhat of a novelty, but now in the same plant will shortly be operated two units of 5000-hp each.

Yet, it is not the mere increase of the size of the unit that demands careful forethought on the part of the designer and manufacturer, but rather the handling with safety of such units, as new problems of detail, construction and operation are brought forth under these new conditions. With the public growing more and more critical day by day, the old central station idea of "what to do in case of an accident" gradually gives way to that of "what to do beforehand to prevent the occurrence of the accident," and yet, with the constant advance in design and manufacture of modern machinery, there should be no reason why, as the size of the unit increases, the tendency of accidents should not rather decrease. The electrical world can well remember when a 500-hp unit was classed a large venture, but it now already seems as if a 10,000-hp unit would soon be well under way. The limit of such development seems to be almost entirely in the hands of the engineer and manufacturer, no limits having yet appeared from the business operating standpoint.

Some Features of Telephone Exchange Management.

In the course of his paper on "Operation and Maintenance," read before the Independent Telephone Association, Mr. E. B. Fisher said: It may just be hinted that the traffic manager and the chief operator must be thoroughly familiar with the isothermal-service lines or special-stress periods of the system when serving a thousand or more telephones. Without this knowledge, it would be impossible to wisely regulate the number of extra operators or substitutes required, or to plan the time programme of the work so that operators may be furnished when the public must have them, and, at the same time, so that these employees may secure time for rest and meals, as all humans require. A mere suggestion in this direction will carry the thought from your own observation to such further requirements as are peculiar to your own plants.

The monitors, in an exchange of 2000 telephones, can earn their monthly salary almost every week in the conservation of material—in the savings of the cords alone, if you please—as well as in their other duties. Your own observation will follow this thought.

The imperative necessity of having competent assistants "back of the boards" needs no lengthy discussion. The switchboard inspection is a department with which, even in small exchanges, most of us are familiar. The wire chief will have in his general charge the department external to the central office, the insulation of inside wires and setting of instruments, the trouble on lines and the repairs or maintenance of toll lines near by. Of course, the traffic manager is watching each one of these departments, and can only secure the best results when personal supervision has taught his subordinates that he is watching all their work.

With regard to the growth of toll service he said: In the exchange with which I am more naturally familiar, our toll service has more than doubled within the past six months, and is still growing at a ratio that almost overwhelms us. We think that with cheaper rates for such service than have been charged heretofore, the popularity of the telephone as a means of communication will increase beyond the wildest dreams of those familiar with this department four or five years ago. This fact is true with the Bell Company, as well as ourselves, and but suggests what we must prepare for. We must be wise in the establishment of rates; we must have our "clearing houses" at convenient points in our respective territories, through which rapid and efficient interchange of business may be accomplished, and we must provide for methods of operation and of maintenance on toll lines not heretofore developed by any independent system in this country. In this field the old company is still learning many lessons, with all of its experience. How much more importance that we begin at once to give it the requisite consideration.

Mr. Fisher closed with the following remarks on low rates: We know of exchanges of 100 or 200 telephones that are undoubtedly being successfully operated in their communities at very low figures of cost. It has been believed by those not well informed that larger systems ought to be, and can be, operated at similar cost. It is true in the telephone business, as it is not true in most other business, that the larger the business the greater the expense pro rata and per capita for operation and maintenance, as well as for construction, where, in a plant of 1000 telephones a rate of, say, $20 to $30 may be fairly successful, in doubling the plant, it will materially increase cost of building and compel a still greater increase per telephone in operating.

I am of the opinion that we need, as well as the public, more information than we have yet secured in this branch, in accepting franchises or ordinances, in the larger cities of the country which are now being developed. We should not be so eager to try to secure them as to perhaps entail a serious burden upon the future of the business in the smallness of the maximum of prices permitted to be charged.

We all know that the old company has exacted an undue profit; at the same time, it would be most unfortunate if the independents should establish a scale of rates for service that would not permit first-class service and a reasonable return upon the investment required for such service. I sincerely hope that any discussion which may follow this paper will consider fully this part of the topic.

The Civil Engineers on Electric Locomotion.

At the recent annual meeting of the American Society of Civil Engineers at Cape May, N. J., the following topic was brought up for discussion on the last day: "What are the economic conditions under which electricity may be profitably substituted for steam in the operation of branch railroad lines, and what are the engineering requirements to be considered in such substitution?" Mr. H. S. Haines said it appeared to him that the only case where electric traction could be successfully used for branch lines was where current could be purchased at a low rate from manufacturing establishments along the line, some of whom developed it from water power.

Col. H. G. Prout, editor of the *Railroad Gazette*, regarded the question as purely one of traffic conditions. Except for frequent short trains doing a suburban or street railway business, he saw no advantage in electricity. So far as the cost of power is concerned a 1000-hp locomotive costs $10,000. A stationary power house of equal capacity costs about $80,000; and if there was any gain in fuel economy through the use of the electric motor, it would be more than offset by the greater first cost of the plant. The fuel cost is only a small item, in the total expense of railway operations. The advantage of the electric motor over the locomotive, if any exists, must be sought in other directions than in fuel economy. Mr. E. S. Davidson instanced a branch line near Pittsburg which was at one time operated as a trolley line but is now operated by locomotives. Prof. Webb, of the University of Pennsylvania, said that the elec-

tric motor was especially advantageous on steep lines and for the operation of railways where small first cost was an essential and the line was made to fit the country with any grades up to 10 per cent. Mr. E. Wegmann said that the steam motors could be designed to climb steep grades if necessary. He had run a steam street car up a 10 per cent. grade. Mr. Baldwin pointed out that where heating of cars was important the locomotive would do the work more economically than the electric current. Prof. D. C. Jackson, of the University of Wisconsin, in regard to the great consumption of power required for electric heating, said that some of the western street railways expect to use as much power in winter to heat their cars as to propel them. Mr. Oberlin Smith expressed some radical views as to the future of heavy traction by electricity and with rubber tired wheels.

Meeting of the Pacific Coast Electrical Association.

After a two days' session, which was taken up with the discussion of practical problems in electricity, the third annual convention of the Pacific Coast Electrical Transmission Association came to a close on June 21, in San Francisco. Prince A. Poniatowski, the newly elected president of the association, presided at the sessions morning and afternoon. The time was taken up with papers by Prof. C. L. Corey, of the University of California, R. S. Masson, L. A. Hicks and C. W. Hutton, of Sacramento, who has charge of the system which supplies the capital city with power transmitted from Folsom.

Prof. Corey's paper on the "Regulation of Alternating Current Generators" was followed closely by all of the members present. It was a discussion from a theoretical and practical point of view, and illustrated with plots and charts. The paper brought out a great deal of profitable criticism. R. S. Masson followed with an able paper on "Facts About Alternating Currents."

The afternoon session was given up to further discussion of the papers that had been presented. A subject of much practical importance, "Electrically Driven Centrifugal Pumps," was handled by L. A. Hicks. As a result of the drought of the past two years, the pumping question has grown to be one of considerable magnitude. The paper pointed out a new field for electricity in the operation of the large number of centrifugal pumps that are being placed in the State, and showed where a wider application of electricity was sure to be made on account of the cheapness and simple methods of application.

The last paper of the convention, on "By What Method Shall Be Determined a Fair Return for Current Supply?" was by C. W. Hutton. One of the greatest obstacles in the way of the general introduction of electricity is the adjustment of satisfactory rates with adequate profit to the power companies. A flat rate is impossible on account of the variations both as to the quantity of power demanded and the period of time for which it is used. Mr. Hutton's plan is a graduated rate based on a uniform flat rate, with increase or decrease in price to consumers according to the time an consistency of their consumption. This was not thought to be feasible by the majority of the members on account of the number of different kinds of meters which it would be necessary to use in the measurement of consumed power.

In closing the session President Poniatowski made a short address, dwelling on the good that had been accomplished in the convention. He advised that more frequent meetings be held, and it is probable that the members will hereafter convene at least quarterly, although no definite time has been fixed. In order to give the members time to digest the contents of papers, they will be sent to each member two weeks before the meetings.

CURRENT NEWS AND NOTES.

VENTILATION OF POLYPHASE MACHINES.—A patent granted June 27 to W. H. A. Rotth, of Berlin, Germany, has for its object the provision of means for securing thorough ventilation of polyphase machinery. By a system of casings, ventilating passages and fan attachments to the rotor, cool air is supplied to the ventilating passages and circulated throughout the machine, the heated air being discharged and its return obviated.

"MARCONI OUTSTRIPPED."—With this caption a cable despatch of July 10 from Vienna gives the following news: "A message has been sent here, thirty-eight miles, with the Hertz wireless telegraph system, thus far outstripping the Marconi system, whose greatest record is thirty-two miles."

A THIRD-RAIL ACCIDENT.—A special despatch from New Britain, Conn., of July 8, says: Patrick Collins, 23 years old, was killed instantly shortly after 8 o'clock this evening while walking on the third-rail tracks of the New York, New Haven & Hartford Railroad. The man stumbled and fell across the third rail. His hands and legs were burned to a crisp.

MILLION-DOLLAR POWER-HOUSE FOR NEW YORK.—Plans and specifications have been submitted to the Department of Buildings for a one and two-story brick and granite fireproof electric power-house, to be erected for the Third Avenue Railroad Company, at the northeast corner of Ninth Avenue and 216th Street, from plans prepared by Westinghouse, Church, Kerr & Co., engineers, who estimate the cost of construction at $1,000,000. The building will have a steel frame, and will occupy a plot 319 x 246. Isaac A. Hopper, who will build the structure, has filed an application for a permit to begin at once to drive piles and erect self-sustaining masonry, necessary for the foundation.

PHASING TRANSFORMER.—A patent was granted July 4 to Prof. H. A. Rowland on a method and apparatus for varying the number of phases of polyphase currents. The method also permits of the transforming of polyphase currents into direct current by setting up by means of alternating currents, dephased m. m. fs., superposing the same and thereby producing e. m. fs. of a number of phases greater than that of the original alternating current, and then commutating the current resulting by a revolving commutator or revolving brushes. The phasing transformers are wheel-shaped, the number of spokes depending on the number of phases, but a single structure being required for any change of phase.

THE COMO EXHIBITION DESTROYED BY FIRE.—The cable brings the intelligence that the buildings in which the electrical exhibition is being held at Como, Italy, were completely destroyed by fire on the morning of July 8. Many exhibits and scientific records, which cannot be replaced, were destroyed, and notwithstanding the fact that the Volta relics were contained in a solid masonry receptacle, many of them were lost. This exhibition was opened on May 15, and was being held to celebrate the discovery of the electric pile by Volta. One of the features of the exhibition was an international telegraph conference at Milan and Como during the early part of June, to which Mr. W. C. Burton, of New York, was the delegate from this country. The telegraphers throughout the world contributed toward the cost of a bronze wreath which was attached to the Volta monument at Como. The exhibition was to have closed in October.

DETROIT'S STREET RAILWAY LAW UNCONSTITUTIONAL.—The Michigan Supreme Court, in an unanimous opinion, has declared unconstitutional the law empowering the city of Detroit to own and operate street railways. The law is declared to be in contravention of the constitutional provision prohibiting the state to engage in works of internal improvements, the point being made that by authorizing various municipalities to operate roads and make transfer arrangements with roads partly without the municipal limits, the state might be covered with railways owned and operated by municipalities, and the state thus be enabled to do through agencies created by itself what the Constitution forbids it from doing itself. The court found it unnecessary to pass on what it calls the serious question whether a committee can be authorized to purchase a vast property and subject the city to the liability incident to the operation of an extensive railway system without giving the people an opportunity to say whether, under any circumstances, a city may own lines wholly within the municipal limits and lease them to others to be operated, this question not being in the case. Competent authority, however, says the effect of the opinion is to answer both questions in the negative.

NEW STORAGE BATTERY.—In a patent granted June 27 to Warren P. Freeman, a type of storage battery plate is described having for a object to combine strength, stiffness and lightness of construction. The plates, rectangular in shape, are provided with V-shaped grooves of a depth less than half the thickness of the plate, and inclined from the horizontal on each side of a central vertical rib on one side, and a groove on the other side opposite the rib. The lugs are offset so that when coupled together the plates are held apart a distance somewhat greater than their thickness, thus enabling the positives to be inserted between the negatives, the groove referred to forming a vertical channel between adjacent plates.

WATER-PAIL HEATING PATENTED.—A patent was issued July 4, on application dated Aug. 20, 1890, to E. M. Bentley, of Boston, covering broadly the well-known water-pail method, so-called, of heating. There are thirteen claims, the first of which reads as follows: "The method of heating conducting material for industrial purposes, which consists of placing the material to be heated at one terminal of an electric circuit and bringing it into contact with a liquid forming the other terminal of a circuit." This method when announced by Lagrange and Hoho in 1893, created, it will be remembered, considerable of a sensation, but it appears that Mr. Bentley's application antedates their publication by almost three years.

FRENCH ASSOCIATION FOR ADVANCEMENT OF SCIENCE.—The 1899 Congres de l'Association pour l'Advancement des Sciences, to be held at Boulogne-sur-mer Sept. 14-21, will be of exceptional interest owing to an exchange of visits between that association and the British Association. Among the features of the meeting will be the unveiling of a statue to the medical electrician, Duchenne, and the inauguration of a sub-section on medical electricity. Among the papers to be read in the latter are the following: "Treatment by Electrolysis of Strictures," by Dr. H. Bordier; "Radioscopy and Stereoscopic Radiography," by Prof. Marie; "Recent Progress in Radiography," by Dr. Bertin-Sans; "Eudodiascopy," by Dr. Bouchacourt.

AUTOMOBILE SWEEPERS FOR PARIS.—A special despatch from Paris of July 8 says: Electric automobile street sweeping machines will be used to clean the streets of Paris before this present summer season is over. The old clumsy dirt machines now in use are to be done away with. The new machine is the joint invention of MM. Thomas and Lerocher. M. Defrance, head of the Street Cleaning Service, has approved it. The new electric automobile has the machine in front. Underneath and behind the machine is a tank for water and a sprinkler. In the rear come the sweepers. These can be raised. The new machine will run over the street to be swept, first sprinkling it. Then it will return and "sweep up." The department is also having built electric carts to carry away the dirt after it is heaped up in little piles.

TRIAL OF STORAGE BATTERIES.—A competitive trial of storage batteries is to be made under the auspices of the Automobile Club de France under the following conditions: The cells are to have a capacity of 120 ampere-hours, and 5 cells will constitute a battery which must not weigh more than 242 pounds, or a maximum of 44 pounds per cell, or 2.5 pounds per ampere-hour. To charge not more than 8 hours will be allowed, the initial rate to be 30 amperes. It will be noted that the maximum weight of battery is excessive, as 44 cells, the number usually required for an automobile, would weigh 2200 pounds. The discharge is to be made both at a uniform rate by means of an automatic rheostat, which will repeat the variations every half-hour. Under the latter condition the battery should have a minimum capacity of 100 ampere-hours. The cells are to be considered discharged when the voltage falls to 1.7. During the variable discharge the batteries will be subjected to a shaking action similar to what they would receive in an automobile.

ELECTRIC MEASURING INSTRUMENTS.—A patent granted June 27 to Harry R. Davis describes a direct-current measuring instrument for indicating the instantaneous values of current or e. m. f. in any given circuit, as distinguished from instruments for regulating or recording the total current or energy traversing a given circuit during a definite interval of time, the object being to provide an instrument simple and compact in construction, having light parts and dead-beat action, and a uniform scale. A pair of permanent horseshoe magnets has clamped between them at each pole ends of same polarity, a soft iron shape with an extension semicircular in form, the two extensions, which project into the space included between the legs of the magnets, being parallel and separated by an air gap. A bobbin shell of aluminum containing the winding of the instrument surrounds one of the extensions, and a clamper plate attached thereto is located in the air gap between the extensions, the supporting pinion being concentric with the curvature of the latter. In a patent granted July 4 to Thomas Duncan, is also described an alternating-current induction motor meter for measuring the energy consumed in induction circuits. To obtain a magnetic field in quadrature, the usual method is to employ a derived shunt current lagged by an impedance coil and supplied to a shunt field coil, then employing a closed secondary in co-operative relation with the latter, the magnetizing effect of each being combined to form a resultant magnetic field 90 degrees behind the pressure. In the method patented, only one shunt coil is employed, which is supplied direct with current that is itself in quadrature with the e. m. f., thus eliminating from the shunt or volt coil all auxiliary windings.

TELEPHONE.—Hutin and Leblanc, in a patent issued July 4, describe a system of multiple telephony and telegraph and also a current-reinforcer which, it is claimed, enables the resistance of a long line both in telegraphy and telephony to be neutralized. A distributer at each end of the circuit acts to connect the line intermittently and successively with a number of telegraph and telephone instruments, one illustration of the patent showing a terminal station for transmitting simultaneously six telephone and six telegraph messages over one pair of wires. The current reinforcer or relay consists simply of a series-wound booster connected in the telephone circuit, the self-induction and armature reaction being neutralized by an auxiliary winding. A patent for a telephone repeater was granted on the same date to George K. Thompson, assignor to the American Bell Telephone Company. A piston secured to the receiver diaphragm, enters a cylindrical chamber containing mercury and forming part of the transmitting and repeating button. It is claimed that the mercury acts as a solid and unyielding mechanical medium between the diaphragm and the carbon-holding button—the transmitter—and conveys thereto the rapid vibrations of the receiver diaphragm with unimpeded strength and unimpaired efficiency. On the same date a patent was granted on a multiplex system of telephone to Hutin and Leblanc, which contemplates the generation of a number of speech-waves by exciting currents of different frequency, their transmission over long wires and their combination in a plurality of receivers with exciting currents of frequencies so chosen that they will in each receiver reinforce or bring out the particular speech waves to which it is desired any particular receiver shall respond. The inventors say they have discovered that speech-waves generated by the action of a transmitter excited by a current of a given frequency can be used to produce speech in a receiver only when the latter is excited by currents of the same frequency. If this condition is fulfilled, proper telephonic transmission results; when these frequencies are different, the sounds produced by the receiver will be unintelligible, and if such difference becomes sufficiently great the receiver ceases to reproduce sound.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material are from the port of New York for the week ending July 4—Antwerp, 1 case electrical material $10; Argentine Republic, 482 cases electrical material $27,027; Amsterdam, 1 case electrical material $25; Brazil, 7 cases electrical material $180; British West Indies, 1 package electrical material $25; British Possessions in Africa, 85 cases electrical material $2,686; British Australia, 73 packages electrical material $29,550; Berlin, 2 packages electrical material $60; Cuba, 9 packages electrical material $183, 19 cases electric light material $212; Hull, 11 cases electrical material $115; Havre, 17 cases electrical material $7,087, 96 cases electrical machinery $2,000; Japan, 1 case electrical material $24; Liverpool, 7 cases electric carriages $7,000; London, 71 cases electrical material $6,121, 50 cases electrical machinery $428; Mexico, 83 cases electrical material $2,251, 11 cases electrical machinery $1,221; Manchester, 33 packages electrical machinery $8,950; Naples, 6 cases electrical material $567; New Zealand, 9 packages electrical material $263; Oporto, 10 boxes electric motors $2,100; Porto Rico, 25 cases electrical material $816; Tasmania, 2 packages electrical material $100; Uruguay, 3 cases electrical material $77; Venezuela, 4 cases electrical material $31.

LETTERS TO THE EDITORS.

Automobiles in Chicago Parks.

To the Editors of Electrical World and Engineer:

Sirs:—It is with feelings of gratification and pleasure that we record the victory that the American Electric Vehicle Co. have won in the habeas corpus case of Harry G. Osburn vs. the South Park Commissioners, of this city, inasmuch as it not only marks an advanced stage of progress in this city in the industry, but also will furnish a precedent for the owners of electromobiles in other cities, to successfully secure the repeal of obnoxious laws now in existence prohibiting the operation of these vehicles on parks and boulevards.

I would like to see a movement for a national association of those interested in this industry. Such an association would be an effective means of securing favorable legislation, and also preventing the enactment of obnoxious laws in the future. We feel that such an organization could be best effected or launched by some one outside of those interested in the manufacturing end of the business.

CHICAGO, ILL. C. E. CORRIGAN.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—In making a series of experiments on the subject of wireless signaling, one or two of what appeared to me as somewhat interesting results were obtained, and as one of these was of a nature having apparently some little bearing on the theory of these Hertzian wave effects, if indeed such they are, and thinking that perhaps one or both of the results mentioned may possibly have been unobserved or overlooked by a part at least of those who are experimenting in that direction, they are given for their consideration.

1. In trying to determine the inductance necessary to choke the waves of currents entering the coherer, I was somewhat surprised to find that a coreless primary for a Tesla disruptive discharge coil, when placed in the coherer circuit between that instrument and the vertical wire, was entirely ineffectual in choking out the currents induced in the receiving circuit. In following this up, it was found

FIGS 1 AND 2.

in a very few minutes' time, that not only was the well-insulated primary coil of perhaps 42 turns entirely ineffectual as a choking coil in either the sending or receiving vertical wire circuit, but that when even a regular alternating current inductance or reactance coil (of about 20 turns wound over a closed magnetic circuit of iron wire perhaps ¾-inch square in cross section), was included in the coherer circuit, the relay's action was by no means stopped.

Connecting up an ordinary gas lighting spark coil in the receiving circuit, as in Fig. 1, the result remained the same, the coherer acting when the vertical wire was connected with the coil at *A*, and remaining silent when the antenna (*B*) was disconnected. Now, then, if the currents induced in *B* are of high frequency, as generally supposed and admitted, why are they not practically damped out by such an arrangement as that described?

2. In trying several forms of radiators, it was found that if the vertical wire was disconnected from its terminal of the induction coil and removed from the same to a distance of a fraction of an inch, perhaps 3-32-inch to 5-16-inch, so that sparks played between the induction coil terminal and the vertical wire, then the effect on the coherer was greatly increased, especially if these little sparks were playing between a small sphere on the lower end of the upright wire and one on the induction coil terminal or in connection with the same, as in Fig. 2.

Now, on lengthening the gap at *E* until the sparking there is stopped, the coherer is still powerfully affected as before, the only sparking in the circuit being that at *D*. While this sparking appears quite weak, judging from the effect on the receiving circuit, it must be the cause of quite a violent disturbance in the circuit *F G*, which having a capacity at both ends, joined together by a wire of low resistance, is probably the seat of electrical oscillations of large amplitude and perhaps of longer duration than would be the case if the spark gap were included in the oscillatory circuit itself, as is customary in the Hertzian experiments.

The results above mentioned have not been obtained or as yet sought for on long-distance work, but merely within laboratory limits, one side of the induction coil and one side of the coherer being left at all times disconnected.

SPRINGFIELD, ILL. JAS. L. ADAMS, JR.

Operation of Station Auxiliaries.

To the Editors of Electrical World and Engineer:

Sirs: In the paper read before the recent National Electric Light Convention by Mr. W. S. Barstow, entitled "The Brooklyn Electrical Supply System for Lighting and Power," and reprinted in your issue of July 1, 1899, certain reasons are set forth as to why "the Union Station was designed and equipped with all auxiliaries electrically operated, the steam from the boilers being used only in the main engine."

The deductions will not hold either in theory or in practice, if efficient feed water heaters are considered for the service. A conservative and perfectly safe estimate of the difference between running everything condensing and running a sufficient part of the plant non-condensing to supply the exhaust steam necessary to heat the feed water up to, say, 210 degrees, can be readily made.

Let us assume the case of a plant developing with one or several large units, 5000 i. h. p., the auxiliaries belt-driven, or electrically operated (though the belt-driven is the more economical) and doing this work on a consumption of 15 pounds of steam per h. p. hour. Then 75,000 pounds of water will have to be made into steam per hour, from water from a hot well at, say, 100 degrees F.

Against this, let us compare another plant, doing the same amount of work with one engine, of, say 500-hp, run non-condensing, and the rest of the engines (4500-hp) operating condensing. With the same steam consumption the condensing engines will require 67,500 pounds of steam per hour; if the non-condensing engine require one-third more steam per hp than the condensing engine, it would be a very liberal estimate. On this basis the 500-hp non-condensing engine will require 10,000 pounds of steam per hour, or the total amount of steam required per hour for this plant would be 77,500 pounds. If we take the most extravagant estimate of the losses from work done, radiation, etc., at 25 per cent. of the total amount of the heat in the steam used by the non-condensing engine, we could still save 75 per cent. of the heat in the steam, or the equivalent of 7,500 pounds of steam; for about this quantity would be needed to raise the temperature of the hot well water from 100 degrees (the same temperature as in the other case) up to the boiling point.

Deducting this from the gross total of 77,500 pounds gives the net total of heat required for generating steam as the equivalent of 70,000 pounds of steam per hour. That is, instead of having to burn coal for evaporating 75,000 pounds of water per hour, it will only be necessary to burn the coal required to evaporate 70,000 pounds of water per hour. The difference is 5,000 pounds in favor of running the auxiliaries with steam and of using the right kind of a feed-water heater and purifier, which besides would improve the quality of the boiler feed supply, no matter how bad.

The equipment required for running the auxiliaries by steam costs considerably less than the other, and the saving will be in the neighborhood (under the actual conditions) of 8 per cent. of the total fuel bill. The plain truth of the matter is that unless the temperature of the feed-water entering the boilers is 200 degrees or over,

no one can afford to run any auxiliaries condensing, direct-driven, or with a motor. The exceptions to this general statement only prove the rule. J. C. JONES.

PHILADELPHIA, PA.

Electrolysis.

To the Editors of Electrical World and Engineer:

Sirs:—I do not agree with Mr. Weightman, "that if the distinction between the meanings of the words 'decomposition' and 'electrolysis' is kept clearly in mind, Dr. Tommasi's paper will be found quite in keeping with modern laws and definitions."

Apparently Mr. Weightman would define electrolysis as that process in which the substances liberated or deposited at the electrodes are produced by the direct action of the current; and decomposition as that process in which the liberated or deposited substances are produced through secondary reactions. He goes on to say that cases of the former, *i. e.*, electrolysis or direct decomposition, are practically unknown.

Again, he says: "As Mr. Goldstein points out, it is, of course, incorrect to speak of the electrolysis of water when the decomposition of water is meant, but I think he will find that few writers are guilty of this error." Reference to my former letter will show Mr. Weightman that I did not speak of the water being decomposed; in fact, I shall show, contrary to what he believes, that the water suffers no decomposition whatever, and that the appearance of hydrogen (H) at one electrode and oxygen (O) at the other can be accounted for by the electrolysis of sulphuric acid alone.

Mr. Weightman calls to aid the theory of the migration of ions, by which he thinks it can be very easily demonstrated that the hydrogen and oxygen are produced according to this reaction:

$$H_2SO_4 = H_2 \text{ (at cathode)} + SO_4.$$
$$SO_4 + H_2O = O \text{ (at anode)} + H_2SO_4.$$

That this is so has never been demonstrated experimentally or theoretically, and the view expressed by Mr. Weightman is due probably to too much haste in offering his criticism. The electrochemical theory warrants the statement that a compound ion, SO_4, for instance, is not necessarily a stable quantity, and may itself break up into a simpler ion, liberating a substance in the molecular condition. Keeping this in mind, the following reaction will be found more rational:

$$H_2SO_4 = H_2 \text{ (at cathode)} + SO_4;$$
$$SO_4 = O \text{ (at anode)} + SO_2;$$
$$SO_2 + H_2O = H_2SO_4.$$

It will be seen here that the sulphuric acid alone suffers decomposition, the water taking no part in the liberation of the hydrogen and oxygen. The fact that H_2 and O are liberated has led many to believe that the water itself is decomposed. The sulphuric acid undergoes electrolysis, the water acting merely as an agent whereby the molecule H_2SO_4 is brought into the electrolytically dissociable condition.

According to the second reaction, we see that the sulphuric acid in a water solution is decomposed by the direct action of the current. Of course, this is an assumption, and bears out the statement made by you editorially, and with which I agree, that it is not a settled question which action is primary and which is secondary in such an electrolysis.

Another point—Dr. Tommasi speaks of decomposing (not electrolyzing) hydrochloric acid. This, according to Mr. Weightman, means that the chlorine liberated at the anode and the hydrogen at the cathode are produced by secondary reactions, because he states that cases of electrolysis or direct decomposition are practically unknown. How Mr. Weightman can hold that view I am at a loss to know. That secondary reactions do take place in the electrolysis of hydrochloric acid in water there is no question; but the result of these reactions is the formation of chlorine oxy-acids which remain in solution, and whose presence can be proven by analysis. To determine the conditions under which these secondary products are formed, I carried out a series of experiments. In one of these, hydrochloric acid, just from the dealer, and labelled chemically pure, was exposed to moist air for an hour. The solution of the hydrochloric acid in the moisture thus absorbed was submitted to electrolysis, the electromotive force of the current being 111 volts. Carbon electrodes were used. Hydrogen and chlorine were evolved copiously. After the experiment, the solution and a portion of the collected chlorine were analyzed; not a trace could be found of the chlorine oxy-acids.

Here is another experimentally demonstrated case of direct decomposition by the voltaic current. Then, Mr. Weightman must bear in mind that when such substances as fused alkaline chlorides, magnesium chloride, etc., are submitted to electrolysis, they undergo direct decomposition, breaking into metal and chlorine, and that cases of direct decomposition by the voltaic current are not so rare as he thinks.

I do not think that Tommasi when he wrote the paper, had in mind the distinction pointed out, and that the fault lies entirely with Mr. Weightman.

So far as I am concerned, I use the term electrolysis to cover both processes. It was so used by Faraday, and is used at the present time by Oswald, Borchers, Classen, Lot, Neumann and Gore. Perhaps it might be well for Mr. Weightman to inform the gentlemen that, in failing to make the distinction he points out, they are guilty of an error, pardonable, however, because they lack a comprehensive knowledge of electro-chemical facts.

I do not see why Mr. Weightman repeats the statement that "the compound which absorbs the least heat tends to be decomposed in preference by the voltaic current." In common with him I hold that this is correct.

NEW YORK, N. Y. HARRIS GOLDSTEIN.

Two-Phase vs. Three-Phase Systems.

To the Editors of Electrical World and Engineer:

Sirs:—In regard to the question of the superiority of the two-phase or three-phase systems, the conditions usually are that the power is transmitted at a high potential, and that the cost of wire for transmission is an important item. To save wire, it is customary for two-phase plants to transform to three-phase for transmission. If this is done, there can be no advantage in high tension two-phase alternators over three-phase, since transformers are necessary. In fact, the three-phase would have the advantage, since it would be unnecessary to use transformers at all, should the voltage not be too high.

The main points which the advocates of the two-phase system claim as advantages over the three-phase, relate to the transformers and the distribution.

Transformers.—It is claimed that there is an economy in transformers, since only two are needed, instead of three. Considering substation transformers, say that 300-kw capacity is required for one bank. If two-phase three-phase transformers are used, it will be necessary to supply 323-kw capacity in two transformers, since the three-phase coil of each transformer must be $2/\sqrt{3}\times$ the capacity of the two-phase coil, owing to the current being out of phase in one transformer, and since the two transformers are usually made identical. So it is a matter of 323-kw in two transformers for two-phase vs. 300-kw in three transformers for three-phase. Thus the saving in increased size has an increased capacity to counterbalance it. As regards safety of operation the three-phase system has a decided advantage. If the transformers are star-connected on the high tension side, the full potential of the line is divided up, so that each transformer has only $1/\sqrt{3}$ of what it would have two-phase.

If, on the other hand, the transformers are delta-connected, primary and secondary, if one transformer goes out, it does not cripple the system, for the other two transformers can still furnish three-phase currents. I have seen two 125-kw transformers on the same phase (out of a bank of six, delta-connected) go out at once from shorting of secondary coils, due to the heating of poor connections. It was not even necessary to shut down, the arc being put out by throwing sand at it. The burnt transformers were taken out one at a time, and when repaired were put back without interruption of service. Another advantage of the delta connection is that if the load is not balanced, the transformers help each other out. Hence with either connection the three-phase has the advantage over the two-phase.

Line Transformers.—In general, the lighting will be single-phase, so that the power transformers are the only ones to be considered. The case here is somewhat in favor of the two-phase, since two transformers of ½ total capacity each, take the place of three transformers of ⅓ total capacity each. Of course, two transformers

can be used with three-phase, but they must be 15 per cent. in excess of the two-phase transformers. However, the saving here will generally be small, especially since the large motors may not require transformers.

Distribution.—The main advantage claimed for the two-phase is in the distribution for lighting. The two-phase as used for this purpose is essentially two single-phase circuits. Provided the three-phase is run out in the same manner as three single-phase circuits—there is no question about the superiority of the former. However, three-phase as usually run leaves the station with three wires, and not with six, for each circuit. The two-phase requires four switches, fuse blocks, lightning arresters and outgoing wires, against three of the same for three-phase. With lightning circuits, three-phase requires three ammeters vs. two for two-phase.

With regard to balancing, where the system is of any extent, a good balance may be easily obtained with three-phase, by balancing the different transformers on the different legs. Provided, the ammeters do not show a close enough balance, it is always possible to change transformers near the centre of distribution until the load does balance. This will not generally be necessary, unless one is over-particular. The difficulty of balancing and of keeping balanced a three-phase system has been greatly exaggerated, and it is partly due to this that the two-phase system is so much used. I do not mean to say that there are not places where the latter is preferable, but they are not so numerous as commonly supposed. Of course it is easier to divide a load into two parts than into three, but provided the load can be easily divided in three parts, this takes away the main objection to three phases. The advantage of saving 25 per cent. in the feeders and mains is certainly worth considering, and provided the load on the branches is divided merely between two of the phases, instead of between the three, the three-phase still has the advantage of 6 per cent. of wire over the two-phase, in that part of the system. As far as regulators are concerned, provided the three-phase is balanced, then one three-phase regulator is sufficient for any circuit. This is usually the case, and generally sufficiently close balance can be obtained to have this answer for all practical purposes.

The delta and the star connections of generators, motors and transformers, besides combinations of the same, give the three-phase a greater flexibility in the different methods of obtaining and of using different voltages, than any other system in use. This is a point which is often of no little practical advantage, since it enables standard apparatus to be used under different conditions of service.

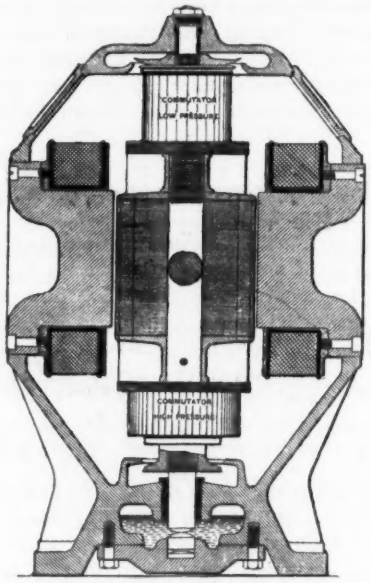
SAN FRANCISCO, CAL. AUG. J. BOWIE, JR.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

High Speed Continuous Current Transformers.—SCOTT.—When comparing estimates of alternating and continuous current schemes, the main difference in cost lies in the transforming apparatus. To lower the exorbitant cost of the continuous current transformer, he proposes a radical change in the construction, consisting in the use of a vertical instead of a horizontal shaft, and a speed some four or five times greater than in present practice. The construction of such a vertical transformer is indicated in the adjoining figure. The result would be a great reduction of the dimensions and of the cost. There would be a considerable saving in floor space which would be specially convenient in the case of balancing transformers and boosters, as used in ordinary continuous current three-wire stations. —Editorially, this arrangement is discussed favorably. It is pointed out, however, that, although it may appear a radical change, it is only the combination of modifications, and their application to transformer design, that is novel. Each separate modification has already been adopted with perfect success in other classes of electrical machinery. The fear is expressed editorially that this new type of transformer may not be so well adapted to substations, on account of lack of safety.—Lond. *Elec.*, June 23.



VERTICAL TRANSFORMER.

LIGHTS AND LIGHTING.

Nernst Lamp.—A note stating that at a recent meeting of the company making this lamp, two indoor lamps were exhibited of 60-cp, 90 watts, 0.45 ampere and 200 volts; their candle-power is questioned editorially; it is admitted, however, that the company now has a practical lamp, notwithstanding that the filament must be heated; the heating is done electrically and the lamp works equally well with either continuous or alternating currents.—Lond. *Elec. Rev.*, June 23.

The report of the meeting of the company is published in the Lond. *Elec.* and *Elec. Rev.*, June 23.

POWER.

Power for Mining Purposes.—GARFORTH.—A short paper read before the Institution of Civil Engineers, on the comparative advantages of electricity, steam and compressed air for mining purposes. He considers high pressure dry steam the most economical power for use on the surface, electricity the most economical and convenient for transmission of power, and compressed air the safest underground. He thinks therefore that a combination of the foregoing will probably prove to give the best results. It is admitted that there are many mines in which it will be perfectly safe to use electricity, provided the cables, motors and accessories combine the latest improvements. —Lond. *Elec. Eng.*, June 23.

CHILDE.—Another paper on the same subject in which he discusses briefly the various applications of power in and about mines, and compares the use of electricity, steam and compressed air in each case, concluding that for general purposes steam is undoubtedly the best for surface work; in shafts and for all underground work, electricity has the advantage over compressed air, except on the ground of safety.—Lond. *Elec. Eng.* and *Elec. Rev.*, June 23.

Kootenay-Rossland Transmission Plant.—LOW.—The first part of an illustrated description. The generating station is at the Lower Bonnington Falls; the power is transmitted 32 miles to Rossland, a promising mining town in British Columbia, where electricity is fast superseding other forms of power for mining work. The power house contains two generators of 750-kw each, a third of 1500-kw being under erection; they generate three-phase current at 11,000 volts, triangularly connected, having a frequency of 60. With 12 transformers of 250-kw the voltage is raised to 20,100 or 11,620, depending on whether the circuits are connected by the Y or the triangle system. The whole line is double and there is a span of 1500 feet across the Columbia River.—The great activity in the use of electric power on the northwest Pacific coast, is discussed editorially.—*Jour. of El'ty*, May.

Failure of a Transmission Plant.—A brief editorial reference to the statement that the operators of the Golden Gate Mill at Mercur,

Utah, have become dissatisfied with the use of electric power and have ordered a steam plant. This mill was operated from the generating station at Provo Canyon, from where power is transmitted to Mercur at 40,000 volts; for a long time this was the highest voltage in commercial operation. The failure is said to be due entirely to the flimsy construction of the pole line which rendered reliable service impossible; no trouble has arisen from the use of 40,000 volts; the interruptions during the winter numbered as high as 14 per month, all due to the causes stated, which are other than electrical.—*Jour. of El'ty,* May.

Riveting Machine.—A brief notice of a description given before the Institution of Naval Architects of Great Britain, of a portable electric riveting machine which has been successfully applied to shipbuilding purposes. It is claimed that it can be advantageously substituted for the hydraulic and pneumatic machines. The capacity of the electric machine is 120 rivets per hour, and it can close rivets up to 1⅝ inches in diameter. The machine described at the meeting is said to have been steadily at work for months, closing 1200 rivets per day of ten hours, with the attendance of only three men and a boy.—*Jour. Frank. Inst.,* June.

REFERENCES.

Coal Cutting Machinery.—Scott.—A short article giving some curves taken from Government statistics during the past 24 years, giving the tons of material raised, the number of persons employed, the deaths due to accidents, etc., intending to show the distinct tendency of a diminution of the number of accidental deaths, especially in recent years when electrical machinery was being introduced. The object of the article is to point out that the serious loss of life may be minimized by the introduction of electrical coal cutting machinery.—Lond. *Elec. Rev.,* June 9.

Electricity in Mining Operations.—Whittaker.—An abstract of an article from the *Colliery Guardian* in which many of the practical questions in connection with electrical machinery in collieries are discussed with special reference to three-phase transmission.—*Eng. Mag.,* June.

Electric Pumps in Mines.—Illustrated descriptions of several forms made by an English manufacturer.—*Lond. Elec. Rev.,* June 9 .

Underground Pumping Plant.—Lasche.—An illustrated description of the plant mentioned in the Digest Jan. 21.—*Zeit. fuer Elek.,* May 14.

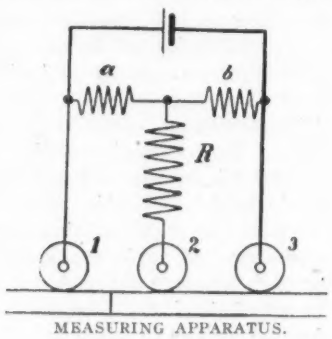
Power for Textile Machinery.—Schelkes.—A description of the transmission plant in which three-phase current to an amount of 1400-hp is used in a large textile factory. The electrical machinery is made by Ganz & Co.—*Zeit. fuer Elek.,* June.

Light and Traction Engines.—The first of a series of articles describing engines made in England. The present portion refers to the generating station of the Waterloo and City Railway.—Lond. *Elec. Rev.,* June 16.

Power Transformation.—Swinburne.—A reprint of the paper abstracted in the Degest, July 8.—*El'ty,* July 5.

TRACTION.

Method of Measuring the Resistance of Rail Joints.—West.—In a discussion of a paper, he describes a simple device for rapidly measuring the resistance of a rail joint in comparison with that of the solid rail. A small coil has three wheels insulated at their axes; these are connected so as to form a Wheatstone bridge, as shown in adjoining illustration, in which *R,* corresponding to the galvanometer



MEASURING APPARATUS.

circuit, is a relay. If the resistance of the joint between wheel 1 and 2 is equal to that of the rail between 2 and 3, the two other resistances *a* and *b* being equal, no current will pass through the relay, but if the resistance of the joint is greater, a current will be indicated. It is not possible to use a telephone in place of the relay, owing to the variations of contact resistance at the wheels. (The resistance of contact of wheels 1 and 3 is included in that of the rails; this, which seems objectionable, could be avoided by connecting the distant ends of coils *a* and *b* to the rails by means of sliding contacts just inside of the two wheels, as the contact resistance of the two outside wheels will then be included in the battery circuit alone and not in the resistances to be compared.)—*Elek. Zeit.,* June 15.

Generation of Power for Electric Traction.—Scott.—The first part of a series of articles, the present portion of which is introductory. There are at present thirty electric traction lines at work in Great Britain and nearly as many in progress; or, including light railway schemes, not less than 80 are projected. Of those installed nine are owned by municipalities and the remainder by companies, the total mileage of single track is about 260. The article, it seems, is intended to discuss chiefly the combination of lighting and power plants; load curves will be given, which show the relation existing between the lighting and traction loads under normal conditions, and in this way he endeavors to show how much or how little importance should be attached to a tramway load, regarded as a day load for lighting stations.—Lond. *Elec. Rev.,* June 16.

Washington.—A long illustrated article on the consolidated street railways of Washington. The lines within the city will be equipped with a uniform underground electric system and for those outside the city limits the overhead trolley system will be used. At the points where these two systems meet, the suburban car will run over a pit in which an underground trolley will be adjusted to the bottom of the car. The Potomac El. Power Co. will be the general supply station for all the suburban lines, those in the neighborhood of the station receiving a direct 500-volt current, while those further away will be operated with a biphase high-tension current which will be transformed down to a 500-volt current at convenient distributing points.—*St. R'y Rev.,* June 15.

Canal Traction.—Hassan.—A communication wherein he discusses the two most favored plans for canal-boat traction. The trolley and propeller plan appears to be the most feasible; the initial expense of line construction would be a minimum, but the boat owner would have to make some changes in his boat. The haulage cable system would have the advantage for the boat owner that he has no changes to make in his boat. He would have to pay simply for the power, but the cost of the latter would be more, as the haulage cable system would necessitate a larger initial expense for construction.—*El'ty,* July 5.

REFERENCES.

High-Speed Electric Railroad.—The building of an electric railroad on the system devised by Behr, between Liverpool and Manchester, is under consideration. It is claimed that the distance of 30 miles can be covered in twenty minutes, and that the cost of motive power will be less than with steam locomotives.—*Eng. and Min. Jour.,* July 1.

Track Construction.—Burke.—An illustrated paper read before the Engineers' Club of Cincinnati, on street railway track construction.—*St. R'y Rev.,* June 15.

Return Feeders of Electric Railways.—Boehm-Raffay.—The beginning of a reprint of a paper which appears to be quite similar to his article on the same subject which was noticed in the Digest, March 25.—*Zeit. fuer Elek.,* June 4.

Electric Traction Accessories.—Cotterell.—In the continuations of his long serial he discusses trucks, brakes and air compressors.—Lond. *Elec. Rev.,* May 5, 27 and June 9.

Pittsburg.—A long, well illustrated article on the system of the United Traction Co. of that city.—*St. R'y Jour.,* July.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Lighting and Traction Stations.—Rider.—A paper read before the Municipal Electrical Asso., in favor of combined stations. He summed up the arguments against combined stations as follows: 1. That the nature of tramway and lighting demands are so different, and the output for tramway purposes so large as compared to that for lighting, that the two undertakings should be separate. 2. That a combined lighting and traction station cannot produce current for tramway purposes as cheaply as the separate tramway stations can. 3. That the importance of an uninterrupted tramway service is so great that the tramway should not be dependent upon any outside source for its power. He endeavored to refute these arguments and claimed that the use of accumulators offers a ready way out of the difficulties. He pointed to the well-known advantages of having one engineering staff instead of two, and the saving in buildings. The paper was followed by an extended discussion. None of the speakers opposed the principle of combined stations where both out-

puts were comparatively small, and most of them favored them under any circumstances. Chamen and Barnard were the principal speakers to point out the undesirability of a combination in case of large stations, Chamen being of the opinion that a large network of tramways should itself certainly have more than one supply station. The paper, with the discussion, is given in the Lond. *Elec.* and *Elec. Eng.*, June 23; the paper alone in the Lond. *Elec. Rev.*, June 23. The paper is discussed editorially in the *Elec.* and the *Elec. Rev.* The *Elec.* points out that there cannot be given a general rule as to whether combined or separate works are to be preferred, but in every case the special circumstances are to be considered. The *Elec. Rev.* agrees that combined works are the best for comparatively small towns. The second argument mentioned in the beginning of this abstract is claimed to be the main one against combined works.

Distribution of Electricity.—TAITE.—A paper read before the Municipal Electrical Association. The system of a large number of house transformers is now being rapidly superseded by the substation system with banked transformers of a capacity of 150 to 200-kw or more. He recommends that the substations should be above ground. Where the demand is too scattered to warrant the expense of substations, the transformer only should be sunk in the ground and the switch and fuse gear should be placed in a pillar box above ground, like the ordinary post office letter boxes. The paper, with discussion, is given in the Lond. *Elec. Eng.*, June 23; the paper alone in the Lond. *Elec. Rev.*, June 23. It is discussed editorially in the Lond. *Elec. Rev.*

Converter Installation.—LEHMANN-RICHTER.—A brief description of the installation in the Palm Garden, Frankfort. The alternating current from the public central station, three miles distant, is used to operate converters which charge accumulators. For exterior illumination on fete days, the alternating current is also used directly. The reason for using continuous currents and accumulators is that much more light is obtained from the arc lamps for the same amount of energy, and they will burn more quietly and silently; the operation of the installation is more sure. There are two high voltage alternating current motors of 55-hp, each of which is connected with a 36-kw shunt generator giving 220 volts, which is distributed by the three-wire system.—*Elek. Zeit.*, June 8.

REFERENCES.

Newington.—An illustrated description of this plant consisting of two sets of 165-kw each and one of 82-kw generating a voltage of 450 to 500 on the outers of a three-wire system. There are 258 cells of accumulators giving 50 amperes for nine hours at 470 volts; a steam dynamo of half the voltage is used for charging the cells and acting as a balancer.—Lond. *Elec.*, June 9, and *Elec. Rev.*, June 23.

Charging Rates in Berlin.—A reprint of the new rates and conditions recently adopted by the central stations in Berlin.—*Elek. Zeit.*, June 15.

WIRES, WIRING AND CONDUITS.

REFERENCES.

Joints for Concentric Cables.—BARKER.—An illustrated description of the system used in Cambridge, England, in the junction boxes, the object being to be able to disconnect and subdivide the cables at the junction boxes so that a fault can easily and rapidly be located.—Lond. *Lightning*, June 8.

ELECTRO-PHYSICS AND MAGNETISM.

Secondary Röntgen Rays.—MALAGOLI and BONACINI.—In determining what becomes of X-rays after they have impinged on a body, the authors divide all bodies into three classes, first those which simply diffuse the rays, those which transform them into other rays having different properties, and finally those which do both. This is analogous to a white body, a black body and a colored body. According to Sagnac there are no bodies corresponding to the white bodies in the case of light, but the present authors point out that Sagnac's transformation is often simply a diffusion and there is no reason to assume the existence of "Sagnac rays;" they conclude that X-rays can be diffusively reflected as such.—*Nuovo Cimento*, April; abstracted briefly in Lond. *Elec.*, June 9.

Detecting Electric Waves.—NEUGSCHWENDER.—If a scratch be made across the silver deposit of a mirror, then by breathing on it, the circuit in which it is connected will be closed; the subsequent effect of an electric wave will increase the resistance again very greatly; the method can therefore be used to detect electric waves. In the present paper he describes investigations made of this phenomenon under the microscope; he found that arborescent growths were produced electrolytically across the gap. Tin, copper, gold and platinum also produced similar results.—*Wied. Ann.*, 68, p. 92; abstracted in the *Elek. Zeit.*, June 15.

Law of Polarization.—PELLAT.—He formulates an important law concerning the polarization of dielectrics in electric fields. The law is as follows: "Any dielectric, whether solid or liquid, placed suddenly in an electric field, acquires a polarization which is not instantaneous, and which increases with the time to an asymptotic maximum When the field vanishes the polarization decreases and becomes zero after a certain time, which is theoretically infinite." He promises a full report on the experiments by which this law is established.—*Comptes Rendus*, May 29; noticed briefly in Lond. *Elec.*, June 16.

Energy Consumed in Vacuum Tubes.—EBERT.—Results of some measurements which support the view that the luminous phenomena in vacuum tubes are due to dissociations brought about by the cathode rays impinging on the gaseous molecules; the greater the valency of the molecule the greater the amount of energy required in its dissociation.—*Wied. Ann.*, 3, p. 608; abstracted with some data in *Science Abstracts*, May.

A Normal Curve of Magnetization of Iron.—FRANKLIN and CLARK.—In a specimen of magnetized iron there are three distinct magnetizing forces holding each other in equilibrium; *a*, the impressed magnetizing poles of the specimen; *b*, a hysteresis magnetizing or demagnetizing force due to magnetic lag; *c*, a demagnetizing force $dV \div dB$ due to a store of recoverable magnetic energy V, which is not yet dissipated by magnetic hysteresis; B represents the induction. The function V may be determined indirectly by determining the curve of magnetization under conditions in which the hysteresis force is obliterated, for, in this case, the curve of B and H becomes the curve of B and $dV \div dB$; this curve the authors call the normal curve of magnetization. They determine three curves of B and H as follows: 1. The specimen was subjected to the operation of demagnetization by reversals at each step; the curve obtained was reversible, but the reversibility does not indicate with certainty that the hysteresis force was obliterated. 2. At each step the specimen was subjected to violent longitudinal vibrations. The curve, obtained by this method, was not reversible, therefore the coercive force was not obliterated. 3. The specimen was magnetized in the ordinary way from a neutral condition. The results of the measurements are given in the form of tables and diagrams.—*Phys. Rev.*, May-June.

REFERENCES.

Theory of the Zeeman Phenomenon.—GOLDHAMMER.—An explanation on the basis of the older magneto-optic theories and without the conceptions of ionic motions.—*Wied. Ann.*, 3, p. 696; noticed briefly in *Science Abstracts*, May.

Plane Electro-Magnetic Wave.—ROSA.—In general, the case of a plane wave is deduced from Maxwell's general equations of the electro-magnetic field. To show more clearly the physical meaning of the equations to students, the author derives them from elementary fundamental principles.—*Phys. Rev.*, May-June.

Physics.—POINCARE.—His annual paper reviewing the progress in physics during the past year; most of the subjects are electrical.—*Rev. Gen. des Sciences*, May 30.

Earth's Magnetism.—SCHWALBE.—An article on the cause of the annual magnetic variation; he gives an exact method for eliminating the diurnal period and the secular variation, thus obtaining the annual periodic variation pure and simple.—*Berl. Phys. Ges. Verh.*, 17, 1898; noticed briefly in the Lond. *Elec.*, June 16.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrodeless Electrolysis.—TROUTIN.—A short article describing the following arrangement for electrolytic decomposition at other places than the electrodes. A beaker with a hole in its side is placed in a larger one, both containing some electrolyte. With the aid of two metallic plates, one in each beaker, a current is passed through the hole, and under certain conditions the arc or luminosity is then seen in the hole, accompanied by bubbles of gas revolved there. The effect is produced with both alternating and continuous currents; the minimum voltage with continuous currents is about 800 and with alternating currents about 500 mean square; the continuous currents were 0.3 to 0.08 amperes and the gases were oxygen and hydrogen, the latter being largely in excess over the theoretical quantities; the oxygen always appeared inside of the beaker no matter what the direction of the current. It remains to be seen whether the gases are evolved in their true electrolytic proportion. The phenomenon may be of practical interest in connection with the leakage currents.

—Lond. *Elec.*, June 23. (See also the abstract under Caldwell Interruptor.)

Editorially the opinion is expressed that this phenomenon is one of masked electrodes rather than one due to the complete absence of electrodes, as the continuity of the electrolyte is evidently broken; the assumption that the ends of the hole are masked electrodes does not, however, explain all the attending phenomena.

Palladium.—COWPER-COLES.—A note presented before the Institution of Mining and Metallurgy, London, on the electro-deposition of palladium. The author has found a solution of palladium ammonium chloride to be one of the best for depositing palladium in a bright form. The best proportions are a 0.62 per cent. solution of palladium ammonium chloride dissolved in a 1 per cent. solution of ammonium chloride. The temperature is about 7.5° F., the current used per square foot being about 0.12 ampere, and the e. m. f. at the terminals of the bath 4 to 5 volts. The anodes can be either palladium foil or carbon.—*Eng. and Min. Jour.*, July 1.

Iron-Silicon.—LEBEAU.—A description of a new process of preparing this material. A mixture of 100 gr. of commercial copper silicide and 40 gr of iron filings, is fused for four or five minutes with 950 amperes at 45 volts, in a graphite crucible. The product is dissolved in nitric acid and the residue is washed with soda and again with nitric acid and then dried, leaving crystals of the silicide of iron.—*Comptes Rendus*, 128; abstracted briefly in *Zeit. f. Elektrochemie*, June 1.

Blot Accumulator.—Another long illustrated description of this accumulator, accompanied by some data determined by Picou for rapid charges and discharges. This is a Planté accumulator, the plates being made of shuttles wound with narrow bands of lead. When charged in fifteen minutes at the rate of 14 to 18 amperes per kg of electrode and discharged at 3.5 ampere per kg, the efficiency in ampere hours was 97 per cent. and in watt hours 70 per cent. Charged in five minutes and discharged with 20 amperes, the efficiency was 89 per cent. in ampere hours and 61 per cent. in watt hours (the weight of the seven plates seems to have been 8.5-kg). It is claimed that the voltage remains very uniform during the discharge.—*Elektrochem. Zeit.*, June.

REFERENCES.

Chemical Action of the Brush Discharge.—BERTHELOT.—A long series of papers on the action of the electric effluvium on various organic and inorganic substances; it is claimed that there is an entirely new field of chemical research opened thereby, which promises to yield much information, such as that concerning the fixation of nitrogen. His experiments have extended over forty years and have already led to certain syntheses.—*Ann. Chim. Phys.*, 16; noticed briefly in Lond. *Elec.*, June 16.

Electrolysis of Hydrochloric Acid.—HABER and GRINDBERG.—A long abstract of two articles from the *Zeit. fuer Anorgan. Chemie.*, 16, page 198 and 329.—*Zeit. f. Elektrochemie*, June 8.

Diaphragms.—BEIN.—An article discussing the dependency of the transmission of solids, on the constitution of the diaphragm.—*Zeit. f. Elektrochemie*, June 1.

Electrolytic Determination of Iron.—An abstract of a description of tests by AVERY and DALES in which the deposited iron and the solutions were analyzed; the former was found to contain carbon and in one case also phosphorus. This is followed by an abstract of a reply by VERWER and GROLL in which they show that no carbon was deposited on the cathode.—*Zeit. f. Elektrochemie*, June 1.

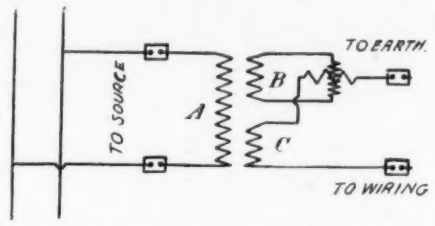
Cost of Desilvering Lead.—Detailed estimates of the costs by the Tommasi process.—*L'Elec.*, June 17.

Conductivity and Dissociation of Electrolytes.—FOSTER.—The conductivity of some electrolytes was measured by the Kohlrausch method, using the alternating current. The degree of dissociation, as calculated from these measurements, was compared with the values deduced from the depression of the freezing points, as found by Loomis. The agreement is close. The results also conform to Arrhenius' dissociation theory. The article contains some figures diagrams and tables.—*Phys. Rev.*, May-June.

UNITS, MEASUREMENTS AND INSTRUMENTS.

New Method of Measuring the Frequency.—KOENIG.—A description of a comparatively simple method requiring but little apparatus and enabling the frequency of the current to be measured without access to the original source. A metallic plate is covered on one side with a thin layer of asphalt varnish; the plate is connected to one pole and a thin wire to the other pole; the point of this wire is moved over the varnish surface, which is then dusted with the well-known mixture of sulphur and minium (or the less poisonous "English red"); then the sulphur powder will adhere to those places which were charged positively and the minium to those which were charged negatively. If the plate is tapped the yellow and red parts will appear distinctly. In this way the frequency may readily be measured if the wire is fastened to the prong of a tuning fork whose vibration period is known; the tuning fork is drawn over the surface of that plate, the resulting curve drawn by the wire being alternately yellow and red, and it can be easily seen how many oscillations of the tuning fork are included in each period of the alternating current. The thinner the layer of asphalt the more sensitive is the method; with 120 volts the record was very sharp; at 36 volts the frequency could still be determined without any doubt; the method may even be used down to 15 to 20 volts, but then considerable care must be taken. The simplest way is to mount the fork and move the plate under it, or else move the fork in guides over the plate; a uniform motion is not required and in some cases it will suffice to move the fork by hand. The results of some tests are given, the fork for which made 435 complete oscillations per second. The limits of a period can be determined to one-tenth, but generally only to one-quarter of an oscillation of the fork, under very favorable circumstances.—*Elek. Zeit.*, June 15.

Instruments for Measuring the Insulation of Alternating Current Circuits.—BENISCHKE.—A description of an interesting form of instrument made by the General Electric Co. of Berlin. The German rules require that the insulation measurements of circuits be made with the voltage for which they are intended to be used; this presents difficulties when the alternating current system is used, as the usual method with a voltmeter as a rule does not suffice, owing to the difference in construction of the alternating current and direct current instruments. The present instrument is an electro-dynamometer and a transformer, as shown in the adjoining illustration. The primary winding *A* of a small transformer is connected with the source of alternating current, the voltage of which is that at which the insulation of the wiring is to be measured. There are two secondary windings, the coil *B* being connected with the fixed coil in the electro-dynamometer, while the second one *C*, is connected through the movable coil to the earth and the other pole to the wiring whose insulation is to be measured. The fixed coil will develop an alternating field of constant intensity; if a current passes through the movable coil the latter will be deflected, the reading being taken on a scale calibrated directly in ohms. The sensitiveness of the instrument may be increased by increasing the number of ampere turns in the stationary coil, which is easily done by means of the transformer shown. The coils *A* and *C* have the same number of windings in order that the voltage at which the insulation is tested is equal to that of the mains. The readings of the scale are correct only when the voltage is the proper amount, and for this reason it is necessary to know whether this is the case; this may be done by the same instrument, which also has a scale of volts and will read the voltage when the two right hand terminals in the figure are connected together. The sensitiveness is so great, that at 120 volts a deflection of 1-mm represents one million ohms, and 3-mm a half a million. The instrument has a further advantage in that it is not injured when a new installation is tested in which there may be a dead ground, as in that case it will give the maximum deflection. which means zero resistance. For switchboard instruments the usual voltmeters will suffice, as the total insulation is as a rule not so very high. With three-phase installations two readings are necessary in order to find the insulation in one of the three wires. In installations having a neutral point, the insulation of the whole wiring can be measured by connecting the high tension winding of the transformer between the neutral point and the earth (referring to the small transformer used in connection with the voltmeter). The instrument which he uses is based on the electro-dynamic screening action and is of the kind described in the recent article (see Digest Feb. 25). He also replies to the criticisms of Szapiro (see Digest March 11), of that instrument, showing that the latter's claims are



METHOD OF MEASURING ALTERNATING CURRENTS.

not correct. The conclusions from the original formulas, he maintains, are quite correct and agree with those obtained in practice.—In the discussion Goerges called attention to the difficulties in applying the voltmeter method to lines of very high voltage which have an appreciable capacity. If, for instance, a voltmeter is connected with or without a transformer between one of the lines and the earth, there will be a current indicated even though there may be no fault in the insulation, because the other two wires form a condenser with the earth, and these currents with high voltage insulations may be quite great. A better method would be to connect the transformer between the zero point of the winding or of the circuits, and the earth; but even then the test fails when the capacities are not equal. Wilkins defended his instrument, which is slightly different from the one above described; it has been in use for a year and a half, is accurate to a few per cent. and is very serviceable in practice. In reply Benischke stated that he did not intend his apparatus for very high voltages.—BENISCHKE. *Elek. Zeit.*, June 8.

Measuring Instruments.—AYRTON.—A reprint of a short paper read before the Institution of Civil Engineers. He mentions very briefly the various improvements that have been made in the materials used in measuring instruments; he discusses also galvanometers, favoring the moving coil type, which he thinks may sometime rival that using a moving needle, for all purposes, even in their sensitiveness. Ammeters and voltmeters are also briefly discussed with reference to their construction, the materials used, the fields, etc. The discussion seems to contain but little of importance.—AYRTON. Lond. *Elec. Eng.*, June 9.

New Unit of Time.—HOSPITALIER.—A short article on what is termed the "natural hour," which is a new unit of time suggested by Lippmann before the French Academy; it is an absolute unit of time deduced from the universal law of attraction. In order to connect the unit of time with the phenomenon of universal attraction the coefficient in the law of Newton is made unity; this Lippmann found to be 3862 seconds, that is, one hour, four minutes and twenty-two seconds. Hospitalier believes that any reform in the present division of time is premature and would create confusion; he admits that the present system could be changed to advantage, but there are many other units and relations which are also absurd, such as the English units, the horse-power, the Baume degrees and wire gauges.—HOSPITALIER. *L'Ind. Elec.*, May 25.

Wehnelt Interrupter.—Messrs. Spies and Wehnelt in a lecture, a brief abstract of which is given in the *Zeit. f. Elektrochemie*, May 18, discuss the theory of the Wehnelt interrupter. They measured the current by means of a voltmeter and also calorimetrically, that is, with a hot wire voltmeter, and found that at less than 100 interruptions the former was only 2.4 per cent., and at about 1000 interruptions 22 per cent. smaller than the latter, that is, the current measured in a voltameter was that much less than the current measured with a hot wire instrument. In both cases it cannot be a sinusoidal continuous current, as the difference would then have been 10 per cent.; at the lower frequency there must be horizontal portions in the current curve and at greater frequencies there must be a return current. It is thought that the electrolytic capacity is the cause of the electrical oscillations. They believe the process is as follows: The charging voltage first forms a layer of gas; "as the degree of charge is greater than the charging voltage" a return current is produced, which again forms anions of the gases and neutralizes the electrolytic capacity, thus allowing the original current to be again produced.—SPIES and WEHNELT. *Verhndl. Deutsch. Physik. Ges.*, 1, p. 53.

Experiments with the Wehnelt Interrupter.—A reprint of an Academy note. He showed that the current in the primary is not oscillatory and does not change its direction unless a condenser is used. He believes the most plausible explanation of the action is that the resistance at the contact of the anode increases so rapidly with the temperature that the energy expended at the surface of contact rapidly heats the anode, thus vaporizing the liquid around it and this forms an envelope of vapor which has an infinite resistance. Equations for the current and the e. m. f. are deduced.—ARMAGNAT. *L'Elec.*, May 27.

Reversed Interrupter.—E. Legrange studied the effect on which the Wehnelt interrupter is based, as early as 1891, at which time he showed that the continuous current was interrupted. In a recent paper, noticed briefly in the Lond. *Elec.*, June 2, he describes experiments made to produce "the unstable" phase at the cathode instead of the anode, the advantages of this being that it is then not necessary to use a noble metal. He made a cathode of small bars of copper attached to large sheets of the same metal. In this way he has succeeded in interrupting currents of 40 to 100 amperes.—LAGRANGE. *Comptes Rendus*, May 15.

Wehnelt Interrupter.—JACKSON.—A note stating that this device was described fifteen years ago by a Russian; a brief account appeared in the Lond. *Elec.*, Dec. 27, 1884, page 133.—Lond. *Elec.*, June 16.

Theory of the Wehnelt Interrupter.—WALTER.—The author, who is well known in connection with the study of the theory of induction coils, believes the usual theory of this interrupter to be erroneous on account of the fact that only hydrogen is set free at the cathode, while the usual theory assumes that the gaseous layer acts as a condenser, which together with the self-induction of the primary coil, causes an oscillating current; if oscillating currents existed there would be a mixture of oxygen and hydrogen on the cathode. He found that both these gases were developed on the anode. His theory is that when the current first begins to flow, oxygen is formed on the anode, the temperature rises until a layer of steam is formed around the anode which reduces the current and the self-induction of the coil thereupon produces a suitable increase in voltage; the layer of steam is electrolyzed by a mixture of the two gases and is finally exploded by a spark, which in turn drives away the liquid, thereby producing a momentary cessation of the current. This current is always unidirectional; the self-induction is necessary in order to develop the high e. m. f. for electrolyzing the steam and exploding the mixture. The construction of induction coils would have to be modified considerably, in order to get the best results with this interrupter; the thickness of the wire of both coils will have to be increased and better insulation will be necessary; the primary should be tuned to the break. The length of the platinum anode which is in the liquid should be adjustable; for every tube and coil there is a certain length which gives the best results; the current which produces the explosive break increases with the length of the platinum wire; the frequency is reduced by increasing the surface of the anode. The primary best suited for the ordinary break does not as a rule give the best results with this interrupter; every induction coil should be provided with an extra primary specially devised for this interrupter. The breaking current, to produce a given length of spark, is much greater than with the ordinary break, but the output per unit of time is immensely greater with the Wehnelt interrupter.—Lond. *Elec. Rev.*, June 23; abstracted briefly from the *Fortsch. Gebiete Roentgenstrahlen*, Vol. 2.

Caldwell Interrupter.—SIMON.—In an article on a modification of the Wehnelt interrupter, he claims priority of invention of the so-called Caldwell interrupter, stating that he applied for a German patent on April 19. He gives a short analytical outline of his theory of the Wehnelt interrupter. As in the closed circuit the resistance is large only at the pointed electrode, the Joule effect will rapidly raise the temperature in this point, thus vaporizing the liquid on the surface of the electrode and interrupting the current; as soon as the current is interrupted, the vapor condenses and the circuit is closed again. He found his equations in good agreement with measurements. He concluded that there would be an interruption whenever the cross-section of the circuit is very small at one point, the rest being large, no matter whether that point is situated at the electrode or in the electrolyte. The interrupter can be made in very different forms; he found the following arrangement practicable: A lead tank is filled with diluted sulphuric acid and forms one electrode; a small beaker suspended therein has its base perforated by one or more holes of about 1-mm in diameter; a lead cylinder in this glass is the second electrode. Another arrangement which he found practicable is the following: A glass tank is cut perpendicularly into two halves; between these is fixed a thin glass plate with one or more small holes. The electrodes are suspended in the two halves of the tank.—*Elek. Zeit.*, June 22. (See also the abstract under Electrodeless Electrolysis.)

Induction Coil Interrupters.—APPS.—A brief mention of a Röntgen Society paper on the Wehnelt and the Caldwell contact breakers. He believes that the cause of the break in the former is the formation of a layer of steam on the anode. He considers the Caldwell break to be deficient in durability and thinks it can be explained on the same theory as the Wehnelt, a bubble of steam forming in the narrow orifice, which is then electrolyzed and exploded; he believes that it should be worked with a higher voltage than the Wehnelt, for when the voltages are equal, the frequency of the former is less. He thinks it premature to discard the ordinary break in favor of these new forms.—Lond. *Elec. Rev.*, June 23.

A 1-Volt Thermoelectric Standard of E. M. F.—L'Ind. Elec., May 25, quotes an additional note by Prof. Barrett to the one noticed in the Digest June 17. He states that that particular thermocouple whose elements are pure iron and an alloy of nickel, manganese and iron, gives a constant e. m. f. of 4 millivolts between 300° and 1000° C., the other junction being maintained at a temperature of 0°. A 1-volt standard is therefore easily constructed by a combination of 250 of these couples in series, the cold joints being kept at 0° by means of melting ice and the hot junctions simply heated in a gas flame. As the voltage remains constant over that wide range of temperature no particular care need be taken to keep the hot temperature at a certain value. The alloy referrd to is one of those made by the Hadfield Steel Foundry Co., of Sheffield.—*L'Ind. Elec.*, May 25.

Apparatus for Measuring the Light from Arc Lamps.—LAPORTE.—A brief abstract of a paper read before the International Society. The object is to obtain more accurate measurements of the light at different angles in a vertical plane, and more independently of the varying position of the arc around the carbons. The essential feature is that two mirrors are used for reflecting the light from two directions on to the same photometric screen, thus giving at once their mean. The arc lamp is rigidly suspended at the centre of a circle over which the two mirrors move in a vertical plane. The two mirrors are evidently placed at the same angle below the horizon. In the original paper the results of measurements are given.—*L'Ind. Elec.*, June 10.

REFERENCES.

Measuring the Hysteresis Loss.—WEBB.—An illustrated description of a method for determining the relation between that loss and the induction for small ranges of induction. His expectations of the method were not fulfilled.—*Phys. Rev.*, May-June.

Incandescent Lamp Photometer.—An illustrated description of a convenient arrangement for making incandescent lamp life tests.—*Elek. Anz.*, June 8.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—A note stating that the government of Trinidad has decided to adopt the Marconi system for communications with Tabago. The greatest distance which has so far been reached is 42 miles, which considerably exceeds any former record. An interesting feature in his late experiments is that he has been able to cut out any desired station; his messages were sent at will to one of two other stations; but he does not explain how this is done. —Lond. *Elec. Rev.* and *Elec. Eng.*, June 23.

REFERENCES.

Protecting Telegraph Poles Against Decay.—An article discussing each of the four processes of treating poles, which have come into general use, namely, the Kyan process with sublimate of mercury, the Burnett with zinc chloride, the Bethel with tar coils containing creosote, and the Boucherie process with copper sulphate.—*Elek. Anz.*, May 28 and June 1.

Use of the Sounder by the German Telegraph Department.—A brief description of a modified adaptation of the American sounder in the German telegraph systems.—MEIVERS. *Elek. Zeit.*, May 25.

Earth Currents in an Atlantic Cable.—RAYMOND-BARKER.—Descriptions of some continuous day and night records of earth current observations made on one of the Atlantic cables which was "making earth" in midocean; several of the curves are reproduced.—Lond. *Elec. Rev.*, June 9.

Distribution of Time.—A long illustrated description of the Zeschall and Resch system. It belongs to that class of systems in which each individual clock has its own works, all of them being set to the correct time periodically by electrical means, from a master clock. The characteristics of the system lie in the method of setting the clocks.—*Elec. Tech.*, May 31.

Telephone Convention.—A brief account of the proceedings of the Convention of the Independent Telephone Assn. at Chicago. Also a reprint of the paper by Reber on the essentials of telephone construction.—*West. Elec.*, July 1.

MISCELLANEOUS.

Graphite.—ACHESON.—A reprint of a lecture on the formation and manufacture of graphite. He considers that the only commercial way to make graphite is by breaking up a carbide by the action of heat in an electric furnace. A plant for this purpose will be erected at Niagara Falls.—*Jour. Frank. Inst.*, June.

REFERENCES.

Municipal Electrical Association.—The presidential address by Proctor at the recent annual meeting is reprinted in the Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, June 16, and *Lightning*, June 15. It is general in character and is chiefly of local interest. A paper by Pearson on municipal trading is reprinted in full with the discussion in the Lond. *Elec. Eng.*, and abstracted quite fully in the Lond. *Elec.*, June 16. He discusses the history of municipal trading in Great Britain since 1848; the paper is quite favorable to municipal trading, and contains much data concerning English installations. A short paper on appropriation of profits and repayment of loans by Maclay is reprinted with the discussion in the Lond. *Elec. Eng.* and *Elec. Rev.*, June 16. A summary of the proceedings of the meeting is begun in Lond. *Elec.*, June 16.

Electrical Industry in Germany.—J. B. C. KERSHAW.—A short article showing the commercial development in that country. The expansion seems to be at a very rapid rate at present, and it is thought improbable that it will continue at the present rate. Some figures are given for the largest companies.—Lond. *Lightning*, June 1.

New Books.

PATENTS AND HOW TO MAKE MONEY OUT OF THEM. By W. B. Hutchinson and J. A. E. Criswell. New York: D. Van Nostrand Co. 232 pages. Price, $1.25.

The main object of this book is to tell how to make money out of inventions and patents, but the volume is divided into three "Books" only one of which is devoted to the subject of money making. Nevertheless, a great deal of valuable information and advice is given in that small space and the book will undoubtedly be of advantage to persons having anything to do with patents. Book II. treats of patents generally, and Book II. of the practice in the patent office, and of trade marks and foreign patents. The subjects are all discussed in a manner to be easily understood and if the advice given is followed, no inventor need go far wrong in the production and exploitation of his inventions. The work is not intended to take the place of a patent solicitor, but applicants for patents will be able to understand from it the spirit in which actions are made at the patent office and will get a good idea as to what constitutes "invention" and what mere "skill."

In the third portion of the book "What" and "How" to invent are described and then the various ways of exploiting or making money out of the inventions. Acting individually the inventor's course depends on several things, to wit: Will he stay in the business to which the patent relates? Is he a prolific inventor? Has he an established business to which the patent relates? Does he wish to establish a business founded on the patent? Does he wish to sell territorial rights? Does he wish to sell for cash? Is he satisfied to license others on a royalty? Whichever of these courses the inventor elects for it, is given the proper procedure. Likewise, in case a stock company is desired, the steps to be taken are given and fully explained. A chapter is devoted to the "promoter" with the conclusion that the modern successful promoter is one of the "smartest men on earth." A good piece of advice offered to the average inventor is that he make an alliance with a good promoter and carry through one good scheme to a successful conclusion, and, it is urged, that this process will be a liberal education in financial methods, which will prove useful to him afterwards. An appendix contains various forms of assignments, licenses, etc., and the forms to be used in the organization and incorporation of stock companies.

REGELUNG DER MOTOREN ELEKTRISCHER BAHNEN. By Dr. Gustav Rasch. Berlin: Julius Springer. 150 pages, 28 diagrams. Price, 4 marks.

Although the title indicates that street car motor regulation is the subject of the book, it has a larger scope, though containing but 140 pages. Chapters I and II, which we may consider introductory, deal with track resistance, work in accelerating trains, armature windings and construction, with special reference to railroad conditions. Chapter III describes the influences of various modes of motor control upon the operation, speed and efficiency of the motors and cause of failure of double-reduction motors on ordinary roads. Chapters IV, V, VI and VII cover respectively speed regulation by resistance, in which the Schuckert controller is described and also a new construction for four motors; series parallel grouping, shunting of field winding and regulation by grouping of sub-

divided field windings. Finally, chapter VIII deals with electric brakes. The book is theoretical in nature but the formulæ are in most instances very simple, and readily understood by those engineers for whom this work is intended. Considering the great advance of the street railway work in the United States, we regret that so little reference is made to American practice and experience. At one or two places such practice is lightly touched upon, but excepting the Walker controller no American device is described and even this not in its practical details, but in diagram. Another controller described is the Schuckert, of the well known German engineering firm.

It is true that sound reasoning and science should be the foundation of all engineering work, yet we can not help but express the thought that an enumeration of the various systems giving practically and commercially good results would vastly improve this otherwise excellent book. As it is intended for practical constructing engineers, we believe that they would like to read, among other subjects, how others have overcome obstacles, such, for instance, the destructiveness of heavy sparking at the controller on breaking heavy currents, wear of contact points, how to prevent accidental reversing when the controller is quickly shut off, or what safety devices are employed when the reversing mechanism is separate from the controller drum. The magnetic blow-out of the General Electric Company and others, the Westinghouse controller and their interlocking safeguard, etc., are mentioned. Such details are essential, because experience has shown that without such details, the desired regulation would soon be out of control. With this exception and the deduction of the relative scope of series and shunt motors, concerning which practice differs on either side of the Atlantic, the book leaves little to be desired. The subject is clearly and systematically worked up, and the graphic methods of determining many factors facilitate the study and enhances the value of the book.

The "Oxide" Electric Lamp.

By W. E. IRISH.

IT would scarcely be politic for an inventor to set forth all the points of advantage and improvements, from his standpoint, in a newly patented device, as by too free an expression of the knowledge gleaned by experiments and study he might give away valuable features it might be his intention later to protect and develop, but which others with the knowledge conveyed and capital at command might more readily avail themselves of. This argument might to a philosopher appear the height of selfishness, whereas to the business man it might appear only just and reasonable. Personally, the

FIG. 1.—SEMI-INCANDESCENT LAMP.

writer considers that it becomes the duty of an inventor to set forth the advantages claimed and covered by any patent granted him when the same is considered of sufficient general interest to warrant technical journals giving the matter space. In accordance with these views the cuts and matter herewith relating to a few of many oxide lamps designed by the writer at various times during the last 15 years are submitted. Figs. 1, 2 and 3 are reproductions from old publications and are given more with a view of showing some of the progressive steps taken up to the patent applied for in 1897, recently issued and more fully described below, than for any other object.

Fig. 1 represents a semi-incandescent lamp, the carbons being in form of a pair of inverted ram's horns, which are freely pivoted at their heavy ends so that they gravitate together at their free and pointed extremities. The free ends of the carbons were inclosed in a short tube of calcined magnesia, koalin or other suitable material molded under pressure and subjected to a high temperature before use. No mechanism whatever was employed in the lamps. The form of the carbons was the chief objection to its adoption.

In Fig. 2 the lower part of the lamp only is shown, but enough remains to make the cut self-explanatory. It will be seen that each of the carbons which described three-fourths of a circle were operated by a single coil and gravity. Supported above the arcing

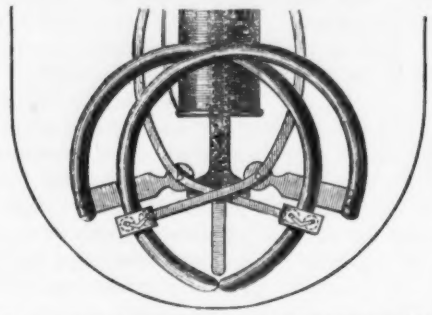


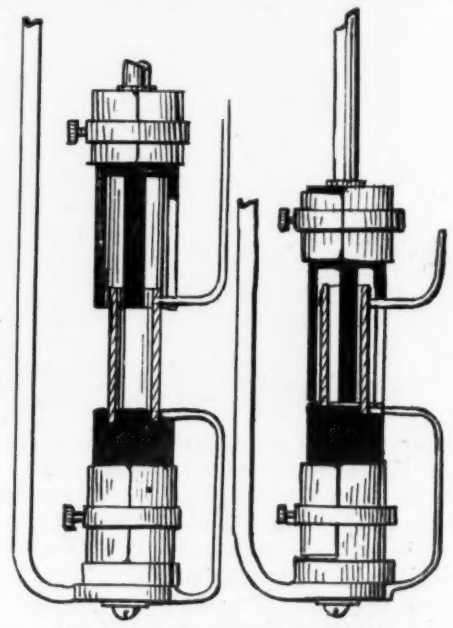
FIG. 2.—DETAILS OF SEMI-INCANDESCENT LAMP.

point was a refractory pencil which was fed down or into the arc and by the same means that established the arc.

When this lamp was in operation the refractory pencil rested on the two carbon points adjacent to or in the arc where it became incandescent. When the circuit was opened the refractory pencil was raised so as to allow the carbons to come together ready to re-establish the arc.

This lamp, like the first, gave excellent results, but they both had the same objection, namely, the difficulty of handling and manufacturing the carbons. In Fig. 3 there is no mechanism shown, but it is hoped the following brief description will make it clear. The top section of the lamp post was provided with a door to give access to the mechanism, which consisted of two carbon holders operated by cords and counterweights running over pulleys at the top

FIG. 3.—SEMI-INCANDESCENT LAMP.



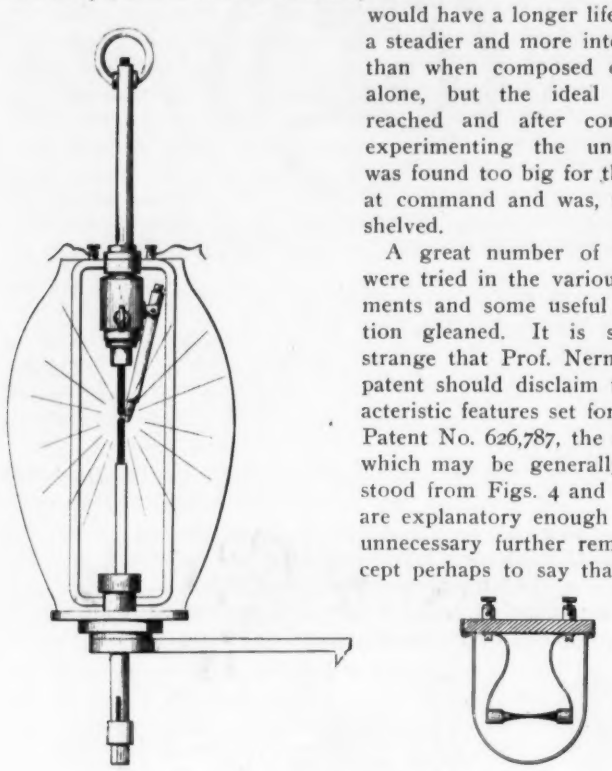
FIGS. 4 AND 5.—RARE OXIDE LAMPS.

of the post. The carbons at their upper extremities rested in contact with each other when the circuit was opened, but when the circuit was closed they separated to establish the arc, at the same time the refractory pencil was released and fed into the arc, or rather fed down until it rested upon the carbon points. Here the pencil quickly became incandescent and then continued to give a beautiful steady light which was vastly superior to that obtained from the carbons alone. When the circuit was opened the refractory pencil was temporarily raised and the carbons again came together and were again arrested in their upward movements by the change of position of the refractory pencil. The carbons as consumed were

fed upwards by the counterweights. Several other designs tried proved more or less satisfactory, but not being on record they will not be described for reasons which are apparent.

In the early days of these experiments it was noticed that the resistance of the lamp fell considerably when the pencils became incandescent and that the arc often disappeared completely, while the pencil still remained incandescent and carried the current necessary to maintain it so.

It was therefore at this early date clearly established that although the pencils when cold were good insulators, they became good conductors when highly heated, and it was further noticed at the same time that there were advantages in employing high e. m. f. With knowledge thus acquired attempts were made to build up a "conglomerate" electrode composed of refractory bodies and carbon as a substitute for the ordinary carbons used in arc lamps, and it was satisfactorily demonstrated that such carbons would have a longer life and give a steadier and more intense light than when composed of carbon alone, but the ideal was not reached and after considerable experimenting the undertaking was found too big for the capital at command and was, therefore, shelved.



FIGS. 6 AND 7.—RARE OXIDE LAMPS.

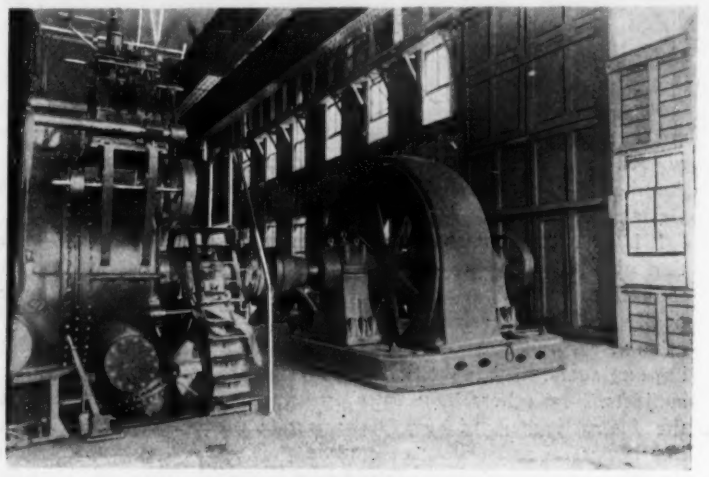
A great number of materials were tried in the various experiments and some useful information gleaned. It is somewhat strange that Prof. Nernst in his patent should disclaim the characteristic features set forth in the Patent No. 626,787, the claims of which may be generally understood from Figs. 4 and 5, which are explanatory enough to make unnecessary further remarks except perhaps to say that the refractory pencils may be hollow or solid.

Fig. 6 represents an arc lamp with refractory pencil resting on the top edge of lower electrode. Fig. 7 represents an incandescent lamp employing an agglomerate filament composed of a mixture of carbon and some other more refractory material as calcium or magnesium oxide.

Enlargement of Niagara Plant.

There has just been installed in the power house of the Niagara Falls Hydraulic Power & Manufacturing Company by the Walker Company, of Cleveland, O., a new dynamo for the Buffalo and Niagara Falls Electric Light & Power Company, of which Frank G. Lott is manager. This large dynamo will be direct connected to one side of the new 2500-hp turbine in the station, which now operates the generator that supplies the current for the operation of the National Electrolytic Company. The new machine is an alternating current dynamo of 700-kw capacity at 2200 volts pressure and will be operated at 250 r. p. m. and at 125 cycles per second. There is also being installed a continuous current exciter of sufficient current capacity to supply the fields of the dynamo to permit of its producing 1100-kw at standard voltage for a short time. The switchboard will be of blue Vermont marble and equipped with all the necessary instruments and appliances.

With this new dynamo in operation the Buffalo and Niagara Falls Electric Light & Power Company will have an additional supply of current for its incandescent lamp system, and when necessary the dynamo will carry 18,000 lamps. At present the company have a small installation in the basement of the Cliff paper mill, and if they so desire the new dynamo will enable them to do away with that plant, while it will also be able to relieve the demand on their Fourteenth Street station, opposite the power station of the Niagara Falls Power Company.



NEW 700 KW 125-CYCLE ALTERNATOR.

The Riker Electric Theatre Bus.

One of the most novel and interesting electric vehicles lately produced in this country is the theatre bus of the Riker Electric Automobile Company, designed by its chief engineer, Mr. A. L. Riker, whose progressive work in this field is so well known. The bus is a handsome and striking vehicle and is already in such demand that a great many will be in service the coming winter.

A number of special features are necessarily studied in a conveyance of this character. It not only has to be light in appearance, but solid in its make-up, as people who use such a bus have a less tender conscience in crowding it than a street railway company has in loading a car. So far as we are aware, this is the largest electric pleasure vehicle in America to-day. It weighs 5500 pounds. Its wheel base is 68 inches, its tread 50 inches front and its rear tread 59 inches. The tires are 2½-inch solid rubber, the front being 36-inch and the rear 45-inch. There are two motors each of 2-kw on the rear axle, the steering being done by the front axle, by the driver, who has all the arrangements handy for control, indication, etc. The vehicle has a capacity of 12 passengers, and can run at speeds of 4, 6 and 12 miles an hour. It will make 20 miles on one charge of the batteries. Although designed specifically as a theatre bus, it is evident that this vehicle has a wide range of utility and is likely to find a various application.

ELECTRIC THEATRE BUS.

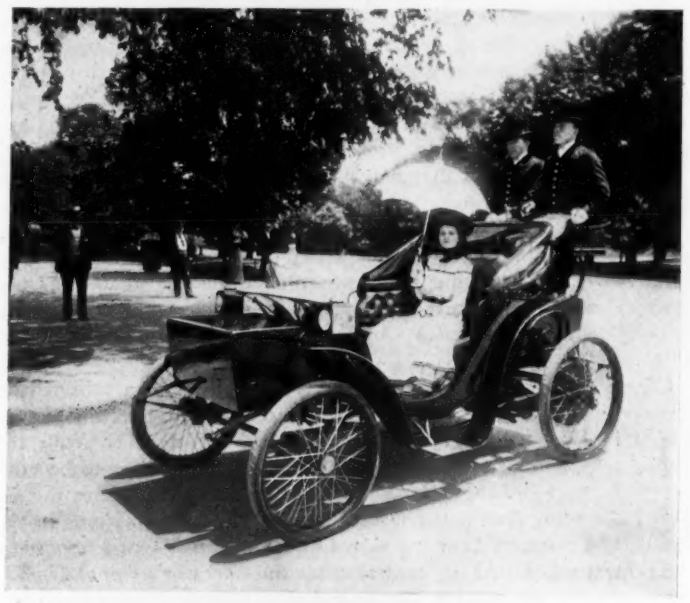
Automobiles For Summer Service.

It is reported from the summer resorts that automobiles, especially those of the electric type, are all the rage, and that everybody is engaged learning how to run them. At Newport, many of the well-known men of wealth and fashion have either their own vehicles or have hired one for the season, or else have sent their coachmen to the electric livery stables to learn the gentle art of

COLUMBIA RUNABOUT.

automobilism. At this season of the year, the lighter or more open classes of vehicle are naturally, preferred, and it is evident that the automobile is destined by its easy control and general inexpensiveness to add driving to the list of pleasures at many places where the keeping of horses has been difficult or very costly. The owner of valuable horses is relieved, moreover, of the anxiety and danger due to their transfer from point to point.

Among these vehicles are two which are here shown. One of them is the Columbia "Victoria-Daumon," being modeled closely after a French carriage of the Daumon type. It is one of these that Mr. Harry Payne Whitney, president of the New York Electric Vehicle and Transportation Company, has adopted for his private use at Newport. As will be noted, it has a large box in front. In France this box is used to carry packages, supplies, etc., for long



COLUMBIA VICTORIA-DAUMON.

distance trips and tours. Here in a carriage fitted for electricity and for city use, it carries half the battery, the other half being in the box over which sit the coachman and the footman. The carriage is an extremely comfortable one to ride in, and has the advantage of a hansom in allowing the occupants to see the view ahead wholly unobstructed. There is one motor of 5-hp on the rear axle, and the batteries are good for 90 ampere hours. The carriage makes easily 30 miles at an average of 8 to 12 miles an hour.

The other vehicle shown here is the Columbia "runabout" of new type. Its occupant is Mr. J. M. Hill, who made in it, as seen two weeks ago, a trip to Coney Island from Sixtieth Street and back, in 1:06 hour outward and 1:08 hour homeward, the return run being accomplished in heavy mud and a pelting rain storm. The total distance covered was about 40 miles. The runabout is rated at that distance, but had on this occasion at least several miles capacity left. Much of the distance was made at 16 to 18 miles an hour. The times given do not, of course, include the ferry trip and delay. This runabout has a battery of 90-ampere hours and a single 3-hp motor on the rear axle. The tires are pneumatic.

The Appert Glass.

During the recent Electrical Exhibition a small but select exhibit that attracted considerable attention was made by the Appert Glass Company, of 141 Broadway, New York City. The manufacture of this industrial glassware, as then noted, is based upon the use of a mold and a core mutually adjusted to the nature of the form required, so that pipe, jars and other shapes can be readily made. Aside from the mechanical operation involved in the process invented by Mr. Leon Appert, is the composition and temperature of the glass itself, which is so controlled as to make possible the molding of large jars in cylindrical shape up to 40 inches high and 20 inches diameter, holding 50 gallons, and in rectangular shape up to 16 inches by 21 inches by 22 inches, and holding, say, 24 gallons.

As was pointed out by President Dulles, of the Appert Company, in a paper on the subject read before the New York section of the Society of Chemical Industry, the reason, of course, why a thin glass, well annealed, will resist intense heat, is found in the fact that, glass being a very poor conductor of heat, the contraction and expansion caused by sudden heat, will make the glass far more likely

SAMPLES OF APPERT GLASS.

to break when thick than when thin. Collateral to this is the necessity for the test of heat and cold that glass shall be of uniform thickness, so that the contraction and expansion will not be different in the different parts of the same article. As a result it has proved possible to make cylindrical glass articles in much larger sizes than any other shape, and blown jars and tubes have, as stated, been made in quite large sizes, though as a rule with less thickness of walls, and correspondingly less mechanical strength. The essential element in the Appert process and the value of the glass produced, is the successful meeting of the two difficulties thus far suggested.

Many applications have naturally suggested themselves for such glass, several being found in the field of electricity, such for example as in storage battery work and in electrolytic plants. A group of Appert products is herewith illustrated, exemplifying the wide range of utility that the material affords. It will, indeed, be remarkable if this glass does not become largely and generally used in the arts.

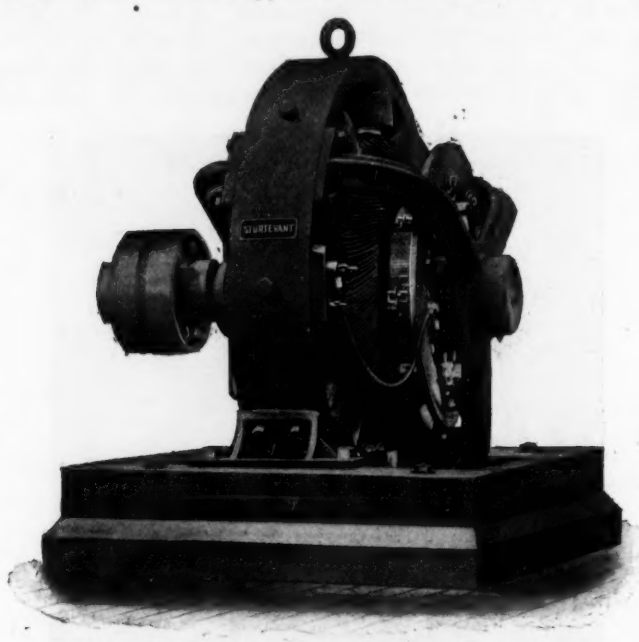
A New Type of 8-Pole Generator and Motor.

In the accompanying illustration is shown a new type of 8-pole machine, which has been brought out by the B. F. Sturtevant Company, of Boston, Mass., and, as indicated by the coupling, is primarily designed for direct connection to a shaft, usually the shaft of a fan.

The field ring, which constitutes the frame of this machine, is made of wrought iron, cast steel or cast iron according to the size, the capacities ranging from a 3-hp up to a 137.5-hp motor, or from a 3-kw generator up to a 110-kw generator.

Wrought iron field cores are used, and a special type of cast iron pole shoe, which by its peculiar shape and size is one of the principal elements in rendering this machine capable of extreme variation of load without sparking of the brushes, or any shifting or adjustment whatever.

The field coils are machine wound, and this form of field being extremely open, the windings present the greatest amount of radiating surface with consequent perfect ventilation, which prevents any great accumulation of heat. As these motors are designed with special reference to low speed and high efficiency, special care has been taken in determining the size of the armature that would be favorable to high efficiency at partial loads, and at the same time allow room for the necessary amount of copper. The armature coils are built up of laminated, slotted discs, mounted upon a cast iron spider, having a hub projection for the reception of the commutator. The core discs are solidly clamped between two brass rings, which have teeth to correspond with the core teeth, and which support them at both edges of the core, and not only protect the teeth from being damaged or misplaced, but present a smooth and well rounded corner for the support of the slot insulation.



8-POLE GENERATOR OR MOTOR.

These armatures are of the coil wound drum type, and usually have the two-circuit winding, although in some cases a multiple winding is used. In the two-circuit winding, there is opportunity for employing larger wire and fewer turns, thereby making the coil simpler and cheaper, while at the same time each coil has only a fractional influence on the total electric force generated, so that the electrical balance of the armature is readily maintained. The special feature of this type of winding lies in the fact that as few as two sets of brushes can be used.

The commutator is of large diameter, with pure rolled or drop forged copper segments, supported in a cast iron shell of spider construction, thoroughly insulated with mica and micanite. Owing to the design, but little energy is dissipated at the brushes, and overheating of the commutator is not likely to occur.

Reaction brushes of carbon are generally used, and supported on a special rigging which is in turn carried by brackets, attached to the field ring. The tripod bearing yokes serve to support the shaft upon each side of the machine, and to render it independent. The bearings are provided with sleeves, which in the larger sizes are self-aligning, and ring oilers are used.

Improved Bryant Lamp Socket.

The lamp socket illustrated herewith has been designed by the Bryant Electric Company, Bridgeport, Conn., to meet the new requirements of the National Electrical Code. It is lined with an insulating material and will withstand a pressure of 250 volts. This

NEW LAMP SOCKET.

socket is practically a new model, and is made with the same care that has always been bestowed by the Bryant Company upon its products. The illustration shows the modified Edison socket.

These sockets are now being introduced in the trade.

The Smith-Vassar Selective Telephone System.

A very interesting expert report has recently been made by Mr. E. W. Caldwell on the subject of the system of the Smith-Vassar Telephone Company, 27 William Street, Mr. J. G. Dorrance, president. It is a "selective system" whose main object is to reduce the number of idle lines in an exchange, or in other words to get the highest carrying capacity out of the expensive circuit connecting central with the subscribers. There are now in use a number of somewhat complicated devices which aim at such results. In the Smith-Vassar system as described by Mr. Caldwell, the subscribers' stations are arranged in groups of 50 to 100 telephones situated in the same locality or along the same general route from "central," and extending from the central office to each group of stations are only enough line wires to provide for the maximum number of telephonic connections that may be demanded at any one time, by the stations in the group.

At a conservative estimate, from six to ten talking circuits would be sufficient to supply service to a group of fifty stations in this manner. All of these talking circuits would be made available for use at every station in the group, by means of branches which terminate at the telephone instruments but which are normally disconnected or "dead."

Connection is established between the telephone at a subscriber's station and the central office by means of a circuit selecting device which is operated by removing the telephone receiver from the hook. This circuit selecting device causes the telephone to be connected with one of the talking circuits which is idle, secures the selected circuit against being used by any of the other stations in the group, and operates over it a signal at the operator's switchboard in the central office. At the central office the operator's signal and the arrangements for placing the operator in communication with the calling station would be similar to those now in use, but a smaller number of annunciator drops or signal lights would be needed corresponding to the reduction in the number of line wires.

Since there are, in this system, no individual lines from central to the subscribers' stations a selective call must be provided in order to enable the operator at central to call up the various stations. The Smith-Vassar selective call requires the use of three additional wires which must be extended to all the stations in a group, and it

enables the operator at central to ring the bell at any one of fifty or more stations without disturbing the others.

If it is desired to connect two stations in the same group, the operator may by depressing a key at the switchboard, cause the circuit selecting device at the called station to connect its telephone with the same circuit which is already connected with the calling station. If the called station is in another group, the operator causes it to select another idle circuit and makes connection between the two lines by means of a flexible cord at the switchboard, in the usual way.

Both the circuit selecting devices and the selective calling apparatus of the Smith-Vassar system are comparatively simple instruments. Mr. Caldwell speaks of the selective call as the simplest and most effective device of this kind he has seen. It may be used for party line service without the circuit selecting system—two of the three calling wires being available for a talking circuit which may be extended to any number of stations. Arrangements have been devised so that when such a party line is in use by one of the stations it is inaccessible to the other stations.

The circuit selecting system works well in the experimental plant. If this system is to be used in connection with, or as a part of additional equipment to exchanges operated on other systems, it will probably require some attention to avoid interference with the busy signals for the various systems. In an ordinary telephone exchange this system would effect a saving of about 85 per cent. in the number of line wires, and switchboard drops or signal lamps. It must be remembered, however, that every one of the talking circuits supplying a group of stations must extend from central to the most distant stations in the group and must have branches to all of the other stations. The lines would be much longer than the average length of the circuits in the old system, but there would still be a saving of about 50 or 60 per cent.

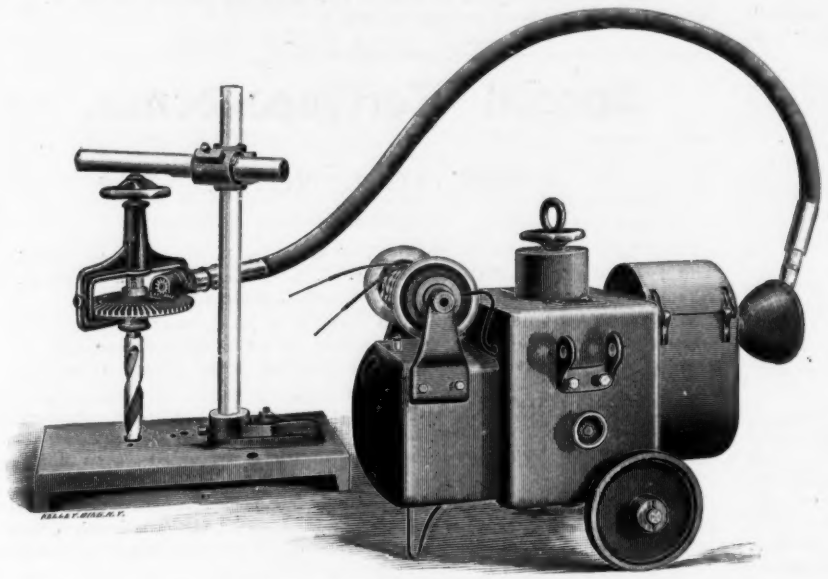


FIG. 1.—PORTABLE ELECTRIC DRILL.

Stow Portable Electric Drilling Outfit.

The portable electric drilling outfit represented in the accompanying illustration (Fig. 1) is the result of careful study and long experience in an endeavor to produce a machine that would meet the requirements, of shop practice. A portable motor to fulfil these requirements must be simple and durable in construction, practically dust and waterproof and capable of running at a variety of speeds. Recent improvements in the method of regulating the speed of this motor have been adopted by the manufacturer, the Stow Manufacturing Company, of Binghamton, N. Y. For a motor of given horse-power the cost has not been increased, the weight has been reduced and the ordinary speed regulator has been abolished. By the new method of regulation (Fig. 2) a variation in speed of about 50 per cent. (embracing all intermediate speeds) is said to be possible. The advantages of this may be appreciated when it is remembered that with the usual method of regulation 5 or 6 variations constitute the limit. The method consists in maintaining a strong and practically constant magnetic field at the pole tips where such is needed for sparkless commutation, while the magnetization of the remainder of the pole face is varied to control the speed of the motor. This is accomplished by making the central portion of the poles movable and thereby varying its reluctance. The pole piece is made hollow and the cavity is fitted with a soft iron core, whose position is adjusted by means of the hand screw at the top. When this core is wholly or partially removed from the cavity the total magnetic flux will be greatly increased, thus raising the speed while the magnetization of the pole tips still remains sufficiently strong for sparkless commutation. In Fig. 2 the relation of the parts is clearly shown.

The standard motors are constructed for voltages of 110, 220 and 500, but machines may be built to order for any practical voltage. The normal speeds of the standard machines are approximately as follows: ½-hp, 1200 r. p. m.; 1-hp, 1000 r. p. m.; 1½-hp, 900 r. p. m., and 2-hp, 750. These speeds can be increased by the use of the company's new speed regulating device about 50 per cent. through all intermediate speeds, and by the substitution of suitable gears much slower speeds may be obtained.

The Stow Company furnishes portable plants with a drill-range as high as 2 inches. Such outfits are particularly suited for repair work on vessels provided by electric current. They have been extensively used by the United States Government and many large manufacturers, both in this country and Europe.

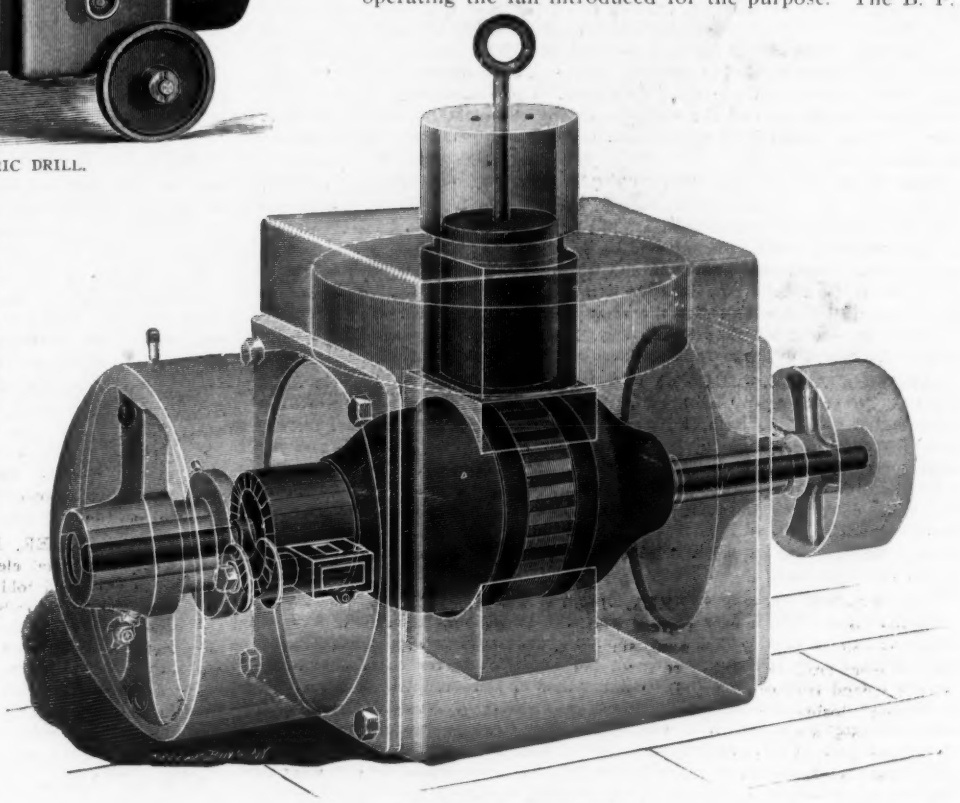


FIG. 2.—METHOD OF REGULATION.

Fan Ventilation.

One of the greatest obstacles in the way of positively ventilating small apartments has been the difficulty of operating the fan introduced for the purpose. The B. F. Sturtevant Company, of Boston, has made a careful study of this problem, has reduced the apparatus to the simplest form, and presents in its Bulletin M illustrations and descriptions of its electrically driven propeller fans. The motor is directly attached to the fan shaft. The fan is of the most efficient type, and the entire arrangement is readily portable. It may be instantly started and stopped by the mere operation of a switch.

NEWS OF THE WEEK.

Financial Intelligence.

BROOKLYN RAPID TRANSIT COMPANY transported 800,000 persons July 4 on its lines. Earnings for the day are estimated at $10,000 more than the combined road earnings for July 4, 1898.

METROPOLITAN STREET RAILWAY has been weak on talk of a strike, but there will be none. A committee representing a large majority of the employees called upon President Vreeland and said they were satisfied with present wages and time.

GENERAL ELECTRIC DIVIDEND.—The directors of the General Electric Company have declared the regular semi-annual dividend of $3.50 per share on the preferred stock, payable July 31, to stock of record July 15. The transfer books will not be closed.

KINGS COUNTY ELEVATED.—The Kings County Elevated road, Brooklyn, N. Y., was sold at foreclosure last week. The Reorganization Committee was the purchaser. August Belmont was the only bidder. The property was bid in for $2,000,000, and the Fulton Avenue property for $1,500,000.

AIR POWER.—The New York *Evening Post* says that the W. C. Whitney syndicate has secured entire control of the American Air Power Company and that it has been decided to equip all the downtown crosstown lines and the belt lines of the Metropolitan Traction system with air as the motive power.

NEW ENGLAND STREET RAILWAYS.—The Massachusetts railroad commissioners have approved the consolidation of the Hanover, Hingham, Rockland and Abington, Bridgewater, Whitman & Rockland and the Braintree & Weymouth street railways on a share for share basis. The consolidated company will be known as the Hanover Street Railway Company.

CHICAGO METROPOLITAN.—During the first six months of 1899 the Chicago "L" road carried 2,200,000 more passengers than in the like period last year. The gain for the six months was practically 19 per cent. The average daily traffic in May was 73,000, a gain of 22 per cent. as compared with the preceding May. This is the best gain shown in any month this year as compared with last.

NEWTON & BOSTON.—The Newton & Boston Street Railway Company, which usually pays dividends at the rate of 1¼ per cent. quarterly, has decided to pass its July dividend, as surplus was very considerably reduced by a serious accident that happened on the road last October. The accident occasioned injuries more or less serious to about 15 people and the claims against the company thereof aggregated something over $6000. These have now, however, been nearly all cleaned up, and the road has during the eight months of its fiscal year to July 1 earned fully 33 per cent. more than it did for a corresponding period last year.

THE NEW ENGLAND ELECTRIC VEHICLE TRANSPORTATION COMPANY now has five electric cabs in operation in Boston and 12 open vehicles in operation at Newport, R. I. The company expects to have its station in the Cyclorama Building, completed by Aug. 1, by which time it will have 30 electric cabs in operation in Boston and will have 30 open vehicles in operation at Newport. The cabs now in operation are in constant use. They are in great demand by physicians for the removal of convalescents. The company will place in service a system of delivery wagons in the fall. The financial outlook of the company is regarded as excellent.

ELECTRIC AXLE, LIGHT & POWER COMPANY.—The Electric Axle, Light & Power Company, with an authorized capital of $25,000,000, has been incorporated under the laws of New Jersey. The company is formed for the purpose of lighting, heating, ventilating and refrigerating railroad cars by means of current generated by the revolution of the car axle. The company is the outgrowth of the National Electric Car Lighting Company of New York. This latter company owns light patents and has had its system in operation on the New York Central, Illinois Central and other railroads. Under its new patents the company claims it will be able to refrigerate cars without the use of ice. The company is backed by a syndicate which includes Mr. Isaac L. Rice.

WEEK IN WALL STREET.—The last week in financial circles with its holiday period represented a great deal of essential dulness and flatness. Toward the end the unfavorable bank statement caused weakness, but there were many reasons cited for the low reserves, such as loans in Europe, great trade activity, dividend transfers, etc. During the week 5974 shares of Western Union were sold, closing at 91, a gain of 1. Of General Electric, 2342 shares were sold, up to 118½, a gain of 1½. Metropolitan Street Railway, weak on strike rumors, sold 11,949 shares, closing at 224, a loss of 3¾. Brooklyn Rapid Transit went to 116¾ on 187,000 shares, a gain of 1¼. In Boston, American Bell Telephone was 345; Boston Elevated 109; Erie Telephone 96½. In the New York outside market, Electric Vehicle, preferred, sold at 120—126 and common, 106—110. Electric Boat, preferred, sold at 45—47 and common at 17—24. General Carriage Company sold at 33—38; General Electric Automobile, 17—24; New York Elec. Veh. Trans., 25¼; Illinois Elec. Veh. Trans., 9—15; N. E. Elec. Veh. Trans, 11¾.

CONTROL OF THE STANLEY COMPANY CHANGES HANDS.—It is stated on good authority that control of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., one of the strongest and best known companies manufacturing alternating current apparatus, has passed into the hands of well known New York parties, and is for the present held by them as individuals, although it is understood that further developments of the most important and interesting character are soon to be expected. The Stanley Electric Manufacturing Company has always been a successful one—indeed, its rise from a small beginning has been remarkable. It was first started in 1891, occupying one floor in a building on Clapp Avenue, employing 16 men, with a capital of $25,000. The present authorized capital is $500,000, with $43,000 subscribed. The first shipment was made in April, 1891. To-day the pay roll numbers anywhere from 250 to 300 men who receive in the neighborhood of $3000 per week in wages. Since the company started it has been called upon to compete with all the great companies of the country, but has built up a business of over $600,000 per annum. In the shops now is $300,000 worth of work. While the sale may be eventually a bad thing for Pittsfield, it cannot be said that stockholders can so regard it, for they have been paid 42 per cent. in dividends in the past eight years and for every $100 they put in originally they now get $150. This showing is a tribute to the management of Mr. Henry Hine and others, more eloquent than anything that can be said. The stock is held for the most part by Pittsfield people and heretofore has been passed back and forth in a small way for about $130 per share. It is understood that the deal or sale does not include the factory, that being the property of Mr. W. K. Whittlesey, and the lease expiring in 1900.

Special Correspondence.

NEW YORK NOTES.

PEOPLE'S SUBWAY COMPANY, of Syracuse, N. Y., has been formed, with a capital stock of $10,000. Directors—J. J. Jernigan and John L. Wentz, Scranton, Pa.; Edward Barneman and Ernest I. White, Syracuse.

MANHATTAN ELEVATED.—The directors on July 11 voted to give a contract to E. P. Allis Company, of Milwaukee, for nearly $1,000,000 for eight engines of an aggregate 100,000-hp for the proposed power house on the East River.

THE SUBMARINE BOAT Argonaut has recently been enlarged and altered at the Erie Basin in Brooklyn, and is again in her natural element. All the operations of this craft are conducted by electric power derived from storage batteries.

MR. GEORGE H. GUY, secretary of the New York Electrical Society, was prostrated recently for two or three weeks by a severe attack of malaria, due largely to overwork. He has been recuperating in the Catskills and returned to New York this week much improved in health.

THE MERCHANTS' ASSOCIATION of New York has secured reduced fares to New York for southwestern territory from July 16 to 20 and August 7 to 10; from the Central Passenger Association from August 7 to 10 and 27 to 31, and from the Trunk Line Association from September 1 to 4 and 10 to 14. The rate is one and one-third fare.

NO POWER TO PLACE WIRES UNDER GROUND.—Corporation Counsel Allen L. McDermott informs the Jersey City Street and Water Board that there exists no power in the city government to compel telegraph, telephone and electric light companies now in operation to put their wires under ground, but that the Street and Water Board may in future grant street privileges to such corporations only upon the condition that the wires be put under ground.

MR. EMBURY McLEAN, consulting and contracting engineer, has removed his office to the Broadway Bank Building, 237 Broadway, New York. Mr. McLean makes a specialty of the economical operation of steam and electric light plants. The McLean system of automatically regulated forced draft will, it is stated, reduce the coal bill from 25 to 50 per cent., and the McLean automatic elevator switch reduces the electric current bill from 40 to 60 per cent.

ROCHESTER, N. Y.—On Sunday, July 2, Frank J. Klueh, a fire hoseman, received a fatal electric shock from a converter on the outside of a building. The chief had told Klueh not to touch anything and apparently he had heard the warning, for he stepped down one step on the fire escape, when he was seen to throw up his hands. Klueh wore no gloves and had on leather shoes, while the other firemen wore rubber gloves and boots. The coroner's jury made a recommendation that the city employ an electrician, whose duty it shall be to remove all dead wires, see that all wires are properly strung, and to give police and firemen such instructions regarding converters and electric wires as shall be for their safety.

NEW GENERAL MANAGER FOR THE SPRAGUE COMPANY.—It will be interesting news to the whole electrical industry that Mr. Henry Hine, the well known general manager of the Stanley Electric Manufacturing Company, has been appointed general manager of the Sprague Electric Co. and has already assumed office. This completes the new list of Sprague officers, consisting of A. B. Chandler, president of the Postal Telegraph Company, president; John E. Searles, first vice-president; Frank J. Sprague, second vice-president, technical director, and Henry Hine, general manager. Mr. Hine has been general manager of the Stanley Company for several years, and will continue for the present in his management of that company as well as of the Sprague Company. He is one of the young men who have made their mark in executive positions during the past ten or fifteen years in the electrical manufacturing field, his experience and association with it dating back to the early United States and Sawyer-Man days.

SALE OF BROOKLYN ELEVATED RAILWAYS.—The Kings County and the Fulton Avenue elevated railway properties, in the Borough of Brooklyn, New York City, were sold under foreclosure on July 6 without opposition. The only bidder was August Belmont, chairman of the Reorganization Committee. The bid for the Kings County road was $2,000,000, and that for the Fulton Avenue line was $1,500,000. The sale is a step in the scheme for the consolidation of the elevated lines with the Brooklyn Rapid Transit Company. The plan of the Reorganization Committee is to turn the properties over to the Rapid Transit Company, which is already engaged in the work of substituting electricity for steam power. The terms of the transfer were arranged some time before the death of Roswell P. Flower, and the stock to be paid by the Rapid Transit Company in the transfer has already been issued and is included in the $45,000,000 of capitalization of that company.

NEW LINE TO MANHATTAN BEACH.—The Brooklyn Rapid Transit Company will soon establish a new electric line to Manhattan Beach, and will take passengers direct from the Manhattan end of the Brooklyn Bridge to the seashore. A traffic agreement has been made with the Kings County Elevated Railroad Company by which the Transit Company will use its road from the Brooklyn end of the bridge to the Franklin Avenue station. The elevated will be equipped with the electric third rail to that station. From there the Brighton Beach route will be used to within a few hundred feet of the Neptune Avenue highway crossing. Here a cross-over will be laid, and the remainder of the distance will be covered over the Long Island Railroad tracks. It is hoped that the new route will be in operation by July 20 at the latest. Trains of three cars each will be sent over the road. There will be express trains, and the fare will be 10 cents.

NEW ENGLAND NOTE.

THE JERNEGAN "CONSCIENCE FUND."—The stockholders of the Electrolytic Marine Salts Company, which went to pieces about a year ago, received a 10 per cent. dividend on July 5. Twenty per cent. was paid a little while ago, and it is hoped that 5 per cent. more will be paid later. A good share of the last dividend comes from the "conscience fund" of $180,000 returned by the Rev. P. F. Jernegan, who promoted the enterprise and who is now supposed to be in Europe.

PITTSBURG NOTES.

THE BELLWOOD ELECTRIC LIGHT COMPANY, of Bellwood, Pa., has been sold by the Sheriff for $7000. The total liabilities were $31,000. This step was not taken because the plant was not successful, but owing to a defaulting on the part of the city solicitor, who had some connection with the light company.

AUTOMOBILES IN PENNSYLVANIA.—The first automobile company outside of Philadelphia has just been incorporated, and it will commence operations in Sewickley, a suburb of Pittsburg. The date for the opening is given as September 1. The company will start with five carriages. The incorporators are: Edward B. Taylor, Dr. R. J. Murray, E. P. Coffin and Dr. H. S. Jackson.

THE PITTSBURG REDUCTION COMPANY, probably the largest manufacturers of aluminum in the world, at present operating factories at New Kensington, Pa., and at Niagara Falls, has decided to erect a third plant. This new one will be built near Shawinegan Falls, in Canada, and it is intended that the product from this factory shall be supplied mainly to the company's Canadian trade. It is stated that the plant, including buildings and electrical machinery used in the production of aluminum, will cost $3,000,000.

ELECTRIC COMBINATION IN BEAVER COUNTY.—A syndicate of New York capitalists has obtained options on all the electric street railway and electric lighting properties in Beaver County, near Pittsburg, with a view of combining these interests into one company. The properties included are: The Beaver Valley Railway, the People's Street Railway, the Patterson Heights Street Railway, the Riverview Street Railway, the Beaver Valley Electric Light Power Company, and the Beaver Valley Gas Company. The capitalization of the new company will be $4,000,000. Messrs. M. W. Conkling and H. A. Fister, of New York City, are at the head of the syndicate.

OHIO NOTES.

ELECTRIC RAILWAY FOR FINDLAY.—Mr. Theodore Wentz and associates have been granted a franchise to build an electric railway line in Findlay.

THE MOTIVE POWER on the Superior Street and Payne Avenue lines, in Cleveland, is to be changed from cable to electricity. An extension operated by electricity is being installed on Superior Street.

THE PAINESVILLE TARGON COMPANY, of Painesville, Ohio, has been incorporated for the purpose of furnishing heat and electricity. The capital subscribed is $27,000, the stock being held by Cleveland people.

MR. J. P. McKINSTRY, vice-president of the Cleveland Telephone Company, was stricken recently with a severe nervous attack resembling paralysis. Several of the best physicians in the city have held a conference and Mr. McKinstry's recovery is doubtful.

THE NATIONAL MAGNETIC ELECTRIC TELEPHONE COMPANY, of Springfield, has been incorporated for the purpose of building and operating telephone and telegraph systems and doing a general telegraph business. Mr. Louis E. Niles, of Springfield, is the largest stockholder.

THE CLEVELAND, WADSWORTH & SOUTHERN ELECTRIC RAILWAY COMPANY is soon to be incorporated to build an electric railway between Cleveland and Wadsworth, touching Akron and Barberton. The Summit county commissioners have been asked for a 25-year franchise.

ELECTRIC RAILWAYS TO CONSOLIDATE.—The stockholders of the Akron, Bedford & Cleveland Railway Company and the Akron Traction & Electric Company have voted to consolidate. The new company is to be known as the Northern Ohio Traction Company, and will have a capital of $3,000,000. The consolidated company will reduce expenses by doing away with the Cuyahoga Falls power station. It is also proposed to utilize the power of a falls in the Cuyahoga River, near Bedford, for generating power. The offices of the new company will be removed to Akron.

THE EASTMAN AUTOMOBILE COMPANY, of Cleveland, is to be incorporated for $100,000 in a few days, to manufacture electric carriages. Mr. C. Eastman, an old bicycle man, is at the head of the concern, and interested in it are President Foster, of the Cleveland Electrical Manufacturing Company, and W. S. Rogers, of the Brush Electric Company. A portion of the old Brush plant is being equipped as a factory, and the company will at once commence to manufacture carriages on a moderate scale. The Eastman carriage shows a new departure in construction, the body being made of steel tubing, with side panels of sheet steel, following on the lines of a bicycle. It is a three-wheel vehicle, and it is steered like a bicycle with handle-bars. Complete the carriage weighs 850 pounds, of which 500 pounds are in the battery. The motor is of 2-hp, manufactured by the Lincoln Electric Company, of Cleveland. The batteries will drive the carriage about 35 miles on one charge, as has been demonstrated by tests. Ribletts Livery, the leading concern of its kind in Cleveland, has ordered five of these carriages to be delivered as soon as possible. They will be used for hire.

INDIANA NOTES.

THE DECATUR TELEPHONE COMPANY, of Decatur, Ind., has been incorporated, with a capitalization of $5000. Messrs. R. B. Allison, B. W. Sholty and G. W. Woodard are the incorporators.

THE STATE LINE TELEPHONE COMPANY has been organized at New Coryden, Ind., with a capital of $10,000. Among the incorporators and directors are Philip Deisch, D. B. Ford and P. T. Waters.

THE EASTERN INDIANA TELEPHONE COMPANY has been organized to give Winchester, Ind., telephone service. The capital to be employed in the enterprise is placed at $5000. The incorporators are V. H. Huston, J. M. Fletcher and J. E. Markle.

ANOTHER ELECTRIC LINE PROJECTED.—R. M. Crouch has asked the commissioners of Grant County for a franchise for an interurban electric railway over the Delphi pike from Converse to Marion, a distance of 24 miles. The road, when built, will connect at Converse with the Wabash & Kokomo line.

MORTGAGE AND BONDS.—The Union Traction Company, recently formed to operate the electric street railroads of Anderson, Muncie and interurban lines, has recorded a mortgage given to the City Trust Company, of New York, to secure an issue of $5,000,000 of bonds. Mr. Charles L. Henry, of Anderson, is at the head of the Traction Company.

COMPANY REORGANIZED.—The Connersville Gas & Electric Company has been reorganized, with a capital stock of $75,000. The new company will be known as the Connersville Gas, Electric & Power Company. Heretofore it has furnished electric light only a short time each night. It is intimated that this is the first move for an electric street railway.

TAXATION OF THE INDIANAPOLIS RAILWAY.—The County Board of Taxation has fixed the assessment of the Indianapolis Street Railway Company at $3,000,000. General Manager McGowan said he would go before the State Board and endeavor to secure a reduction. He claims there will be a heavy drain on the company by the cost of improvement, the direct tax of $30,000 a year to the city and taxes on so large an assessment as $3,000,000 would be unfair. The County Board fixed the company's assessment at $2,200,000 last year, and the State Board raised it to $3,000,000.

ANOTHER INTERURBAN COMPANY.—Messrs. Stone and Webster, who, together with Boston capitalists, recently purchased the Terre Haute Electric Street Railway Company, are also the prime movers in a company incorporated a couple of weeks ago for the purpose of constructing electric suburban and interurban lines between Indiana cities. The company has been incorporated under the name of the Indianapolis, Plainfield and Western Rapid Transit Company, and is capitalized at $100,000. The first line to be built will be a line from Terre Haute to Brazil, a distance of 16 miles.

A NEW ELECTRIC COMPANY.—The Logansport, Rochester & Northern Traction Company, of Logansport, has filed articles of incorporation. The capital stock is placed at $100,000. The purpose is to build an electric line between the cities named and have the line connect with the Logansport and Indianapolis line. The directors named are: J. E. Berger and George W. Holman, of Rochester; John D. Wildman, of Warsaw; L. W. Welker, of Albion; Henry I. Fark, of Kendalville; J. T. McNary, B. F. Keesling, W. A. Osmer and S. M. Velsey, of Logansport; C. M. Foster, of Chicago, and C. G. Davis, of Benton Harbor.

CHICAGO NOTES.

MR. WALTER CARY, vice-president of the Milwaukee Electric Company, Milwaukee, was in Chicago last week. He reports that his company is running to its full capacity, and is making an addition to its shops which will place it in a position by next fall to fill new orders promptly.

MR. EDWIN M. SMITH, manager of the Cleveland Electric Company, Cleveland, Ohio, was a visitor in Chicago last week. He is sanguine as to the future of the electrical business in his line during the coming fall. His company has increased its capacity in order to better care for the anticipated increase in trade.

WISCONSIN NOTES.

RAILWAY EXTENSION ENJOINED.—The Milwaukee Electric Light & Railway Company has been enjoined from extending its tracks in Waukesha. The matter has been taken to the courts for settlement.

ARTICLES OF INCORPORATION for the Oshkosh & Stevens Point electric railway were filed July 5. The capital stock is placed at $150,000, and the incorporators are A. L. Thompson, Colonel H. B. Harshaw and A. E. Thompson, of Oshkosh.

THE WISCONSIN TELEPHONE COMPANY is busy buying out the independent telephone companies throughout the state. On July 4 it took charge of the exchanges and wires of the Wisconsin Valley Telephone Company, including exchanges at Eau Claire, Chippewa Falls and Menominee, together with several hundred miles of wire.

A TRUCE has been sounded in the legal battle between the Milwaukee Light, Heat & Traction Company and the city of Kenosha over the attempts of the former to lay its tracks in the streets of Kenosha. An effort is being made to bring the parties interested on both sides together for the adjustment of the difficulties. The Milwaukee Light, Heat & Traction Company is having an ordinance drawn up providing for an entirely new franchise, which will be submitted to the common council of Kenosha, it is expected, at its next meeting.

THE ELECTRICAL DECORATIONS during the Milwaukee Carnival are worthy of mention and those that planned and carried out the ideas deserve credit. Besides a great number of designs of various character, there were numerous large buildings outlined and in other respects fitted up. Probably the finest piece of electrical work was the arching of about two miles of the principal business streets. Two methods of doing this work were employed. Arches made of T-iron in combination with a wood strip spanned the street at every side trolley wire pole. The arches had a very good appearance and effect. The other method was the suspending by belted lights over the street. These belts took different forms and were more irregular than the iron arches. Messrs. Rohn and Meyer deserve credit for the ingenious way in which this work was done.

RAILWAY COMPANY TO FURNISH ELECTRIC POWER.—There is now pending before the common council of La Crosse, Wis., an ordinance that proposes to give to the La Crosse City Railway Company the right to furnish electric power to corporations and individuals for mechanical and manufacturing purposes. Heretofore this field has been occupied exclusively by the Edison Light & Power Company, and the passage of the proposed ordinance means the culmination of an unfriendly feeling that has been growing between the street railway and the Edison Company. Some months ago President P. E. Edwards, of the Street Railway Company, proposed a consolidation of his company with the three illuminating companies now under joint management—the Edison Light & Power Company, the Brush Electric Light & Power Company and the La Crosse Gas Light Company. This was declined by the illuminating people, owing to the great difference in favor of the illuminating companies in the dividend-earning capacities of the several investments.

ST. LOUIS NOTES.

STREET RAILWAY ENJOINED.—The St. Clair County Court granted an injunction last week, on application of the Suburban Railroad Company, against the East St. Louis & Belleville Railroad, preventing the latter company from tearing up tracks or interfering with the traffic of the former company.

CARS TO RUN FOR CHARITY.—The East St. Louis Electric, the Day Electric and the Suburban Electric Railway Companies have agreed to give the proceeds of one day's run of a car on each road for the benefit of the Protestant Hospital. Some day this week will be designated, and prominent ladies will collect the fares on the cars.

ANOTHER DEMAND FOR A FRANCHISE.—The promoters of a franchise for the Maplewood & Jefferson Barracks Electric Railway Company in the Circuit Court last week again requested the granting of the franchise. The court stated that several property holders who objected to the building of the road could not be present so set the hearing for July 17.

NEW ELECTRIC ROAD.—The East St. Louis Electric Railway Company, Julius S. Walsh, president, presented to the County Board of Supervisors last week a petition for permission to construct a double track electric road and operate it for twenty years, along the East St. Louis & Brooklyn road from East St. Louis to Brooklyn. The road is to connect and be operated in conjunction with the East St. Louis road.

THE LINDELL RAILWAY SUIT.—The State Supreme Court en banc denied the Attorney General a writ of ouster against the Lindell Railway Company, of St. Louis. This suit was brought by the Attorney General against the Lindell Railway Company under the allegation that it was a trust. Shortly after it secured a renewal of its franchise from the Municipal Assembly for a period of 50 years, and absorbed the Aline Street, the Laclede Avenue and the Market Street lines. The allegation was made that the company was in the nature of a trust and contrary to the state statutes. The case was argued and submitted by the attorney for the company and Attorney General for the state some weeks ago. The state asked that the franchise be revoked and the transfer of the lines declared void.

TEXAS AND MEXICO NOTES.

A COMPANY of American capitalists has sent a representative to Acapulco, Mexico, to investigate the situation there, with a view of establishing an electric light plant.

THE HICO ELECTRIC LIGHT COMPANY, of Hico, Texas, has been incorporated, with a capital of $1600. The object of the company is to establish an electric light plant in the town of Hico. The incorporators are V. F. Wieser, J. F. Wieser and F. A. Wieser.

THE CONROE COMMUNICATION COMPANY, of Conroe, Texas, has been incorporated, with a capital stock of $1000, for the purpose of establishing a telephone exchange in the town of Conroe. The incorporators are A. E. Gilbert, L. H. Frazer and W. M. Conroe.

AUSTIN'S PLANT ALL RIGHT.—Superintendent H. C. Patterson, of the Austin (Texas) municipal electric light and power plant, states that the recent great flood in the Colorado River did no damage to the dam across Lake McDonald and that the power house, which is located immediately below the dam, also escaped injury.

MR. T. B. RICHARDS, an electrical engineer, formerly of Denver, Colo., has applied to the authorities of the state of Tamaulipas, Mexico, for a concession in the way of an exemption from state taxation for a term of years on an electric light and street railway plant which he proposes to establish at Tampico. A tram line was built at Tampico a number of years ago, but has been abandoned for several years. The old line was built to handle freight as well as passenger traffic.

PACIFIC COAST NOTES.

BARB WIRE TELEPHONE LINE.—The farmers around Le Grande, Merced County, Cal., are connecting their homesteads with a barb-wire-fence telephone system that is working very successfully.

PROPOSALS FOR ELECTRIC LIGHT BONDS.—The Board of Trustees of Ukiah, Cal., has advertised for proposals for the purchase of an $18,000 electric light bond issue. Proposals will be received until July 25 next.

THE CALIFORNIA POWER COMPANY, of San Francisco, has been incorporated, with a capital stock of $30,000, for the purpose of manufacturing and selling power. The directors named are S. W. Ferguson, A. P. Woodward, T. J. Ryan, J. H. Barnard and H. W. Snow, San Francisco.

THE SACRAMENTO ELECTRIC, GAS & RAILWAY COMPANY has secured control of the Capital Gas Company, of Sacramento, Cal., which was a formidable competitor, operating both gas and electric plants. This appears to be a victory for the former company over the latter, with its allies, the Central Electric Company and the South Yuba Company. A lively rate war was kept up for several years.

THE TRUCKEE RIVER GENERAL ELECTRIC COMPANY has been organized by California and eastern capitalists for the purpose of generating electric power near Floriston, Nev. The directors named are Mortimer Fleishacker, Sigmund D. Rosenbaum, Allan Pollok, Albert J. Hichtman, Frank H. Burk, Ludwig Schwabacher and Herbert Fleishacker. The capital stock is placed at $2,500,000. The stated object of the incorporation is to supply electricity for power and light in San Francisco and other places, but it is understood that the Comstock Lode will be the first locality supplied with current.

CONDUITS FOR WIRES.—The Merchants' Association, of San Francisco, recently drafted a city ordinance, by the terms of which all electric light, telephone and telegraph wires will be placed in underground conduits. This ordinance, which was prepared at the request of the Board of Supervisors, divides the city into four districts. There was some apprehension that the measure might be contested by some of the corporations interested, but the principal companies handling electric currents in the city have agreed to comply with its provisions. The companies referred to are the San Francisco Gas & Electric Company, the Western Union Telegraph Company, the Postal Telegraph-Cable Company, the Gold & Stock Telegraph Company, the Southern Pacific Company, the San Francisco District Telegraph Company and the Pacific Telephone & Telegraph Company.

CANADIAN NOTES.

MESSRS. W. D. M'NAIR, of New York, and J. S. Clarke, of Ayr, Ont., are promoting an electric railway to run from the town of Ayr to Berlin, Ont.

ALUMINUM PLANT AT SHAWINEGAN FALLS.—The company controlling the Shawinegan Falls, Que., it is currently reported, has induced the Pittsburg Reduction Company to invest $3,000,000 at the Falls in the manufacture of aluminum.

THE CANADIAN ELECTRIC LIGHT COMPANY expects to commence work at an early date on the development of the Chaudiere Falls water power for which plans have already been drawn up. The project includes the construction of an electric railway.

RAILWAY FRANCHISE IN BARRIE.—The Royal Electric Company is said to have made application to the Town Council of Barrie, Ont., for a franchise for an electric railway between that town and Allandale, Ont., with the privilege of extending it to other points.

THEFT OF ELECTRICITY.—The Secret Service Bureau of Montreal, Que., has had intrusted to it a case which will create a stir when it is given publicity. It appears that a systematic theft of electric power has been carried on by a number of firms in Montreal, which use electricity for motive purposes. Its detection will necessitate steps on the part of electric companies to overcome the facility with which the scheme can now be operated.

MUNICIPAL LIGHTING PLANT AT NIAGARA FALLS, ONT.—A by-law to raise by debentures $71,000 for the purchase of the Niagara Falls Electric Light Company's plant by the town of Niagara, Ont., was carried by an overwhelming majority of the rate payers a few days ago. The object in the purchase of the plant is to utilize the power during the day time, when not used for light, for the Ontario Silver Plate Company, which decided to move its works to that town, if the power franchise could be secured.

PROJECTED RAILWAYS ABOUT OTTAWA.—The project of the Ottawa Suburban Railway Company to construct a system of electric radial railways,

centering on the Canadian capital, has been kept very quiet. Nothing very definite has been heard of the scheme until it was presented before the Railway Committee of the Dominion House of Commons a few days ago. The company, which is said to be abundantly responsible financially, proposes to build about fifty or more miles of electric road in the vicinity of Ottawa.

General News.

THE TELEGRAPH AND TELEPHONE.

ASTORIA, ORE.—The Oregon Telephone Company is building a branch line from Astoria to the seaside.

ROSSLAND, B. C.—The Columbia Telephone Company has applied for a franchise to build lines in this city.

CENTRAL POINT, ORE.—Messrs. Holmes Bros. are constructing a telephone line from this place to Eagle Point.

OSWEGO, N. Y.—The Ontario Telephone Company has completed two metallic toll lines connecting Oswego with Fulton.

RICHMOND, VA.—A charter has been granted to the Chesterfield & Powhattan Telephone Company, which was organized a few weeks ago by prominent citizens of the two counties.

BAKER CITY, ORE.—The Inland Telephone Company's lines will be extended from the trunk line at Baker City to the terminus of the Oregon Railway & Navigation Company's branch.

LEXINGTON, KY.—The City Council has granted franchises to the Fayette Telephone Company, which will at once begin erecting lines in this city and county. The system will be operated in opposition to that of the East Tennessee Company, which was supposed to have the exclusive franchise in this city.

BURLINGTON, IOWA.—The Iowa Telephone Company has completed its new line as far west as Fairfield and the men are now pushing on toward Ottumwa. Copper wire is being used throughout. The line from Mount Pleasant to Salem has been changed to metallic and extended to Hillsboro. An office has also been opened at Middletown.

BOSTON, MASS.—The sale of the Southern Massachusetts Telephone & Telegraph Company to the New England Telephone & Telegraph Company has been effected. The Southern Massachusetts Company heretofore controlled the telephone systems in New Bedford, Fall River, Taunton and Brockton, as well as the towns in Bristol County and on the Cape.

ELKTON, MD.—The Cecil Telephone & Telegraph Company, of this place, has been purchased by a syndicate of Philadelphia capitalists, who are interested in various telephone lines on the eastern shores of Maryland, Delaware and Pennsylvania. The new company will at once extend the line to all parts of Cecil County, and will connect with nearby systems.

YONKERS, N. Y.—The Palisades Telephone Company, of this city, has been incorporated at Albany, with a capital stock of $250,000. The company will erect lines from Yonkers to various adjacent cities, towns and villages. The directors are Manning Merrill and Thomas T. Hill, of Brooklyn; George W. Romaine, William P. Catlin, A. T. Holbrook and George P. Dresher, of New York, and George B. Catlin, of East Orange, N. J.

BOSTON, MASS.—General Manager Baker, of the Southwestern Telegraph & Telephone Company, telegraphs that long distance service is interrupted at Columbus, on the Southern Pacific road, and at the Brazos River, on the Houston & Texas Central Railway, and that on the main line of the Houston & Texas Central Railway about 41 miles of pole line is under water, but that good service is being rendered between North and South Texas via Austin and Palestine. The damage to the Southwestern Telegraph & Telephone Company will probably not exceed $5000.

LOUISVILLE, KY.—The Lexington Telephone Exchange has decided to make new rates for its local patrons, and it hopes, under the new order of things, to increase the number of telephones from 3100 to 5000. The new rates will be as follows: For residences, $2.50 per month, with a discount of 50 cents for advance payments. This rate will entitle the subscriber to 60 calls per month. All extra calls must be paid for at the rate of 5 cents each. The unlimited rate will be $8 per month, with a discount of 50 cents for advance payments. It is stated to be the intention of the company to open up new lines, develop suburban stations and generally boom telephone interests throughout the south.

WORCESTER TELEPHONE COMPANY.—The incorporators of the Worcester Telephone Co. (capital stock $200,000) are as follows: Henry F. Harris (president), attorney; treasurer, West Boylston Manufacturing Company and director, Worcester Safe Deposit & Trust Company; J. Russell Marble (vice-president), Jerome Marble & Co., and director, First National Bank; Hon. William P. Searls (treasurer); Albert H. Waite (director), president, First National Bank; Henry S. Pratt (director), president, Citizens' National Bank; Edwin P. Curtis (director), proprietor, Richardson Manufacturing Company; General A. B. R. Sprague (director), treasurer, Putnam & Sprague Company, vice-president, Mechanics' Savings Bank, ex-mayor; William Hart (director), real estate; T. S. Johnson (director), clerk of the Supreme Court; William S. Slocum (clerk); George A. Smith, cashier, Citizens' National Bank; Edwin Brown, American Card Clothing Company; Colonel F. W. Wellington, Wellington Coal Company; W. W. Johnson, Ware-Pratt Clothing Company; counsel, Messrs. Hopkins, Smith & Hopkins.

ELECTRIC LIGHT AND POWER.

KENOSHA, WIS.—The Kenosha Electric Light & Power Company has increased its capital stock from $30,000 to $75,000.

REDWOOD CITY, CAL.—An ordinance has been introduced in the council proposing a bonded indebtedness for an electric light plant.

GEORGETOWN, S. C.—The Georgetown Electric Company has been organized by L. K. Bull, of Racine, and E. E. Mandeville, of Camden.

UKIAH, CAL.—An election was recently held in this place on the question of bonding the town for an electric light plant. A majority vote was cast in favor of the proposition.

LA CROSSE, WIS.—Mr. Henry A. Salzer, of this city, has purchased the Darlington Electric Light & Water Power Company's plant, of Darlington, Wis., paying therefor $25,000. Mr. Salzer will continue to operate the plant.

RALEIGH, N. C.—It is stated that a syndicate is being formed by Senator Cameron, of Pennsylvania, to establish a big electric light plant at Roanoke Rapids to supply electric light. The line will run from Raleigh to Norfolk

PEORIA, ILL.—The boilers of the electric light plant at Fairview exploded recently injuring three people, one of whom, the engineer, has since died. The building was completely wrecked and the town is in darkness in consequence.

TOM'S RIVER, N. J.—The Tom's River Electric Light & Power Company has been incorporated, with a capital stock of $25,000. The incorporators are Thomas H. Smith, Aenas S. Bailey, of Lakewood; Burhaus Van Steenburgh, New York City.

MONTGOMERY, ALA.—It is stated that $500,000 are to be expended in establishing a power plant on the Tallapoosa River to furnish current to Montgomery, both for light and power purposes. The transmission will cover a distance of 30 miles.

JERSEY CITY, N. J.—The Butte Lighting & Power Company has been incorporated in this state, with an authorized capital of $1,000,000. The incorporators are William J. Canning, William S. Brayton, Charles E. Estabrook, Christie P. Hamilton and Thomas K. Henderson.

GRASS VALLEY, CAL.—The Nevada County Electric Power Company will erect a substation here from which the lines of this district will be supplied with electric power and the city itself with arc lights. The company will connect with the Yuba Electric Power Company's plant.

CHICAGO, ILL.—Mayor Harrison's annual report, just issued in bound volume, says that "the city is now operating a total of 2923 arc lamps and has the largest municipal electric street lighting plant in the world." The total yearly cost per light is put by him at $68.50. Including interest, depreciation, etc., it is probably well over $100. The city has appropriated $150,000 to extend the system in 1899.

PLACERVILLE, CAL.—The electric power plant of the Bowker & Boulder Mining Company, at the junction of Rock Creek and the American River, eight miles from this city, was recently destroyed by fire. The capacity of the plant was 110-hp, which power was transmitted for the operation of the Bowker & Boulder quartz mines at Kelsey. It was installed about 12 years ago, and is said to have been the first plant erected in this state for long-distance transmission of electric power. The loss is $15,000.

THE ELECTRIC RAILWAY.

ALTOONA, PA.—The local traction companies have increased the wages of their employees about 10 per cent.

HARTFORD, CONN.—The Hartford & West Hartford Horse Railway Company will be sold at auction in this city on Aug. 1.

COLUMBUS, OHIO.—The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company, of Hamilton, has increased its capital stock from $35,000 to $750,000

MARIETTA, OHIO.—The stockholders of the Parkersburg & Marietta Traction Company announce that the building of an electric road between the two cities is a certainty.

HARRISBURG, PA.—A charter has been issued to the Butler Passenger Railway Company, capitalized at $50,000, to build a street railway line eight miles long in the borough of Butler.

INDIANAPOLIS, IND.—The Kokomo, Wabash & Northern Electric Railway Company has been incorporated here to build an electric railway between Wabash and Kokomo. The capital stock is $13,000.

INDIANAPOLIS, IND.—The Indianapolis, Plainfield & Western Rapid Transit Company has been incorporated to build an electric railway to Plainfield, Danville and other western points. The capital stock is $100,000.

BELLAIRE, OHIO.—The boycott placed on the Bellaire, Bridgeport & Martin's Ferry Electric street car line eight weeks ago has been lifted and the cars are now in regular operation. The men are receiving 17½ cents per hour.

MT. VERNON, N. Y.—Franchises have been granted to the New York, Westchester & Connecticut Electric Railway Company to lay tracks through some seven miles of city streets. The franchises were also wanted by the Union Railway Company.

STREET RAILWAY STRIKE IN LONDON, ONT.—A street car strike at London led to the calling out of regular troops on July 9 and a dispersal of the mob at the point of the bayonet. The company has been trying to operate with non-union men.

NEW ROCHELLE, N. Y.—It is stated that the Union Railway Company, better known as the "Huckleberry Road," has practically effected the purchase of the Larchmont Horse Railroad Company, of Larchmont. The Larchmont road is three or four miles long.

PHILADELPHIA, PA.—The Union Traction Company has purchased some property on South Fifth Street on which it will erect a brick and iron storage battery house and equip it with a storage battery. The company has also two other buildings in contemplation.

CHICAGO, ILL.—The Chicago Union Traction Company is endeavoring to secure the Chicago General Railway Company's road. Outside of the General Railway, which is a small line, there remain only the Chicago City Railway and South Side Electric lines to be taken in.

BOSTON, MASS.—The trustees of the Massachusetts Electric Companies have effected a permanent organization by the election of the following named gent'emen as officers: President, Amos F. Breed, of Lynn; vice-president, Chas. E. Cotting; secretary, E. W. Burdett; treasurer, J. H. Goodspeed.

DEDHAM, MASS.—The newly organized Brockton, Canton & Dedham Street Railway Company has petitioned for a location in this place. The directors of the company are John J. Whipple, Henry C. Johnson, R. S. Ryan, Frederick C. Hinds, George W. Wetherbee and E. T. Paul.

HARRISBURG, PA.—The East McKeesport Street Railway Company, of McKeesport, has been incorporated to construct a street railway about 3½ miles in length. The capital stock is $25,000. The incorporators are C. S. Mitchell, C. W. Lepper, John S. McFarland, C. S. Mitchell, W. J. Carson and Frank H. Clark.

COLUMBUS, OHIO.—It is stated that plans have been completed to consolidate the Columbus Street Railway and the Central Street Railway of this city. The former operates about 65 miles of track and the latter about 34 miles. The combination represents about $9,000,000, the aggregate stocks and bonds of the two companies.

NEW YORK, N. Y.—It is stated that the Whitney street railway syndicate has arranged to build a trolley line in Rio Janeiro, Brazil. Chief Engineer Frederick S. Pearson, of the Metropolitan Street Railway Company, is now in Rio making surveys. The necessary franchises have been secured and the capital for the enterprise has been subscribed.

CHATTANOOGA, TENN.—Chancellor McConnell has decided that the city of Chattanooga has no right to grant exclusive franchises to electric railways. He therefore dissolved the injunction to the Chattanooga Electric Street Railway Company a few days ago restraining the Chattanooga Rapid Transit Company from laying its tracks on Market Street, this city.

PITTSBURG, PA.—The Union Traction Company now has its system completed with through connections in the towns immediately surrounding Pittsburg, and has a route covering many miles of territory. The council of East McKeesport has granted the company the right of way through the borough, this being the last link in the connection between Pittsburg and the surrounding territory.

GLENS FALLS, N. Y.—The Warren County Railway has been incorporated to build an electric freight and passenger road from Warrensburg to Lake George, a distance of seven miles. The capital stock is $200,000, and the principal stockholders are State Treasurer A. B. Colvin and J. M. Coolidge, of Glens Falls; J. A. Powers, of Lansingburg, and Congressman L. W. Emerson, of Warrensburg.

LEAVENWORTH, KAN.—The Leavenworth Electric Railway Company, owning and operating 12 miles of track through this city to Fort Leavenworth and the Soldiers' Home, has been sold to the Leavenworth & Kansas City Electric Railway Company. It is stated that the price paid was $200,000. The purchasing company is made up of Cleveland (Ohio) capitalists, who now have an electric railway half completed between Leavenworth and Kansas City.

DUBUQUE, IOWA.—An option on the Dubuque Street Railway Company's property has been closed, it is stated, by a syndicate, including W. Fred Snyder, Sidney L. Wright and E. C. Gibson, of Philadelphia, and W. D. Chapman, of Akron, Ohio. It is stated that an option has also been sought on the property of the Dubuque Light & Traction Company which operates a parallel line, and that one has been obtained on the property of the Star Electric Company, which holds the city lighting contract.

YORK, PA.—The property of the Pennsylvania Traction Company, a corporation whose lines are principally in Lancaster County, is about to be sold under an order of the United States Circuit Court upon foreclosure proceedings brought by bondholders and the Provident Life & Trust Company, trustee of the mortgage under which the bonds were issued. The property is at present in the hands of a receiver, who has been operating the road since the foreclosure proceedings were brought, in the latter part of 1896.

STANDARD OIL AND WESTERN ROADS.—As to a project already noted in these pages, the Chicago *Times-Herald* says: "It is authoritatively stated that the Standard Oil Company is negotiating for the purchase of street railway systems in various western cities. Knowledge of the plan to acquire a chain of such properties as were profitable came to light through the work of an expert in the employ of the company, who is said to have been inspecting the plants in Sioux City, Omaha, St. Paul, Minneapolis and other cities, making thorough inquiry regarding the life and provisions of the franchises, the condition of the rolling stock, and every other point bearing on the actual and possible value of the property."

PERSONAL.

MR. G. H. SMITH, a young workman in a tinplate factory at Cardiff, England, claims to have devised, on the Marconi plan, but with many improvements, a system of wireless telephony.

MR. H. B. SLATER, manager of the Canon City (Col.) Electric Light & Power Company, was in New York recently, making purchases of apparatus, etc. It is some years since he last visited the East.

MR. GANO S. DUNN, chief engineer of the Crocker-Wheeler Company, was compelled by exhaustion from the heavy work of the past winter to take an early vacation at Haines Falls, N. Y. He was so far incapacitated as to be unable to attend the Institute meeting, but is now in much better health.

MR. THOS. G. GREER, of the Western Electric Company, of Chicago, has been taking a short vacation in the Eastern States, and was in New York last week making hurried calls on a host of old friends and acquaintances.

MR. F. A. GILBERT, president of the Boston Electric Light Company, is a director in the Missouri, Kansas & Texas Trust Company of Kansas City, now to be located in Chicago, with double its present capitalization of $1,250,000.

MR. OSCAR T. CROSBY will, it is rumored, take a long European trip at an early date and thereafter devote much less of his time to business and more to the literary and technical subjects that have a first claim upon his tastes and special ability.

MR. H. R. WELLMAN, who has been electrical engineer for the Armitage-Herschell Company, North Tonawanda, N. Y., for some three years, resigned from that position on July 10, to take a similar position with the General Incandescent Arc Lamp Company, of New York City.

MR. LUTHER STIERINGER has returned from a long western jaunt and is the recipient of a fine gold watch, with appropriate inscription, from the New York Electrical Exhibition management as a token of their appreciation of his work in the public behalf at Madison Square Garden last May. The tribute is not less handsome than well deserved.

MR. G. H. CONDICT, the expert of the Electric Vehicle Company, has moved to Hartford, Conn., as consulting engineer for the Columbia electric automobile interests. To pass upon all the new designs, types, freaks, standards and original possibilities is a task of no mean order; but Mr. Condict has coped successfully with other large problems.

OBITUARY.

MR. HERBERT H. BROOKS.—Many of our readers will be extremely sorry to learn of the death last Sunday afternoon of Mr. Herbert H. Brooks, who has for the past nine or ten years been general manager of the American Circular Loom Company, of Boston. Mr. Brooks had not been at all well for some years, being frequently subject to attacks of pneumonia, and about two years ago his most intimate friends learned with much uneasiness and sorrow that consumption had taken firm hold upon his system. Two winters ago he was undoubtedly benefited by a long sojourn in New Mexico, and the past winter he spent in the Bermudas, but unfortunately without any beneficial effect. On returning from the Bermudas he was taken very seriously ill, but his friends were all surprised and delighted to see him out again during the past few weeks of warm weather, and were beginning to hope that he might live for a considerable period when a sudden hemorrhage last Sunday afternoon cut him off in a few minutes. Mr. Brooks was widely known to the supply men all over the United States, and had also many of the central station men as his friends. Every one who knew him liked him, on account of his genial, warm manners, and it would be difficult to find another in the electrical business who was more widely known, more uniformly liked, or who will be more missed. Mr. Brooks leaves his mother and one brother to mourn his loss.

Trade and Industrial Notes.

THE WESTERN ELECTRIC COMPANY has distributed copies of its Bulletin No. 7002, descriptive of the arc lamps of its manufacture. A copy of this bulletin will be mailed to anyone upon request.

THE CHASE ELECTRICAL CONSTRUCTION COMPANY is the name of a new Chicago concern organized to manufacture and deal in electrical apparatus. The capital stock is $10,000. It was organized by A. P. Peck, C. A. Chase and A. B. Wilson.

MR. H. J. GORKE, so long identified with the electrical supply trade in Syracuse, N. Y., has found it necessary to increase his store capacity, and has moved to 305 South Clinton street, opposite the St. Cloud Hotel, where he carries every line that the art knows.

THE STANDARD STEEL WORKS, Philadelphia, Pa., has recently issued an artistically gotten up a catalogue of steel tires and wheels, steel castings and steel and iron forgings for railway purposes. It contains several excellent illustrations of the works and their products.

THE STANDARD WELDING COMPANY, Central Avenue and Cone Streets, Cleveland, Ohio, recently organized, announces that it has taken over the seamless steel tubing, electric welding of bicycle parts and general welding business of the Standard Tool Company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., in its circular 51, just issued, describes and illustrates the installation of chloride accumulators in the Dun Building, New York. This installation was fully described in the ELECTRICAL WORLD of Aug. 13, 1898.

THE GENERAL EQUIPMENT COMPANY, of Camden, N. J., has lately received large orders for switchboard circuit breakers from the Electric Storage Battery Company and for street railway circuit breakers from the Newtown Electric Street Railway Company and the Camden & Suburban Railway Company.

FIREPROOF STORE HOUSE.—The Berlin Iron Bridge Company, of East Berlin, Conn., is erecting at Bridgeport, Conn., for the Armstrong Manufacturing Company a fireproof store house. The framework is of steel, and the covering is of corrugated iron lined with the Berlin Company's patent anti-condensation fireproof roof lining.

THE COLUMBIA VEHICLE & ELECTRIC COMPANY has paid $200,000 for the plant of the New Haven Carriage Company. The plant thus acquired will be used for the manufacture of the bodies of the automobiles. It is said that orders for 1000 wagons will be filled immediately. The local officers of the New Haven Carriage Company remain in charge of the acquired plant.

THE COMMERCIAL ELECTRIC COMPANY has been incorporated in Chicago to manufacture electrical machinery. The capital stock is $10,000, and the incorporators are H. N. Rose, D. I. Sicklesteel and James R. Hastings.

THE WESTERN ELECTRIC COMPANY, Chicago, has brought out a very artistic catalogue of its "Petite" long-burning enclosed arc lamp of different classes and types for alternating current. The illustrations and diagrams give a very clear idea of the lamp and its operation.

MESSRS. LOWE & LEVERIDGE, 183 Greenwich street, New York, report having closed a contract in June for one 50-kw multipolar generator, direct

connected to an American Ball duplex compound engine, and one 125-kw companion unit, together with the necessary switchboard and engine room fittings, for the store of James McCreery & Co., New York.

CROSS ARMS.—To meet the large demand for telephone and electric light cross arms the Electric Appliance Company, 92 and 94 West Van Buren Street, Chicago, has for several years past been operating its own cross arm factory. It has a very extensive plant for this line of work just outside of Chicago. The company is working its factory night and day to keep up with the demand for these goods.

ROCKAWAY, L. I.—The Rockaway Electric Light & Improvement Company was incorporated July 8 at Trenton, N. J. Capital stock, $15,000. It will install an alternating dynamo of 600 16-cp capacity, including engine. Benjamin Blum, of 699 Broadway, New York, is the engineer in charge, and is the owner of a street franchise and lighting contract. A contract for construction will be sublet.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has issued a patriotic calendar for July. It is printed in various colors, and gilded. The first, third and fourth days on the calendar are printed in different colors to render more conspicuous the events commemorated on those days, viz., the battle of San Juan Hill, the naval victory at Santiago and the signing of the Declaration of Independence.

DOMESTIC ELECTRIC LIGHTING.—The desirability of the electric current for domestic lighting is yearly growing in favor. The houses that have been constructed during the last six months are now being wired, and the enterprising central station manager is not neglecting to place current in old houses during the good times. The Central Electric Company, Chicago, is well pleased with the demand for material for interior wiring.

MR. GEORGE W. WOLLASTON, manager of the London salesroom of the Joseph Dixon Crucible Company, Jersey City, N. J., in a recent report, says: "In the electric tramway system of the continent of Europe, Persia and other outlying countries, we are breaking our way for Wood Grease. Have just contracted for a shipment of ten barrels of this graphited grease to Alexandria, Egypt. We have supplied several barrels to the tramways at Ostend, which are girdled all over the coast and running into the country much the same as in Jersey City."

FORT WAYNE DUNCAN INTEGRATING METERS for alternating currents are well described and illustrated in a recently issued catalogue by the Fort Wayne Electric Works, Incorporated, Fort Wayne, Ind. The operation of this meter depends upon the induction principle. The instrument is simple in construction, and is free from rubbing contacts, since there is no revolving wire. The extensive meter department of this company is also illustrated. The testing and calibrating laboratory, recently completed, is claimed to be the finest in the country for its purpose.

PICNIC OF THE JEFFREY COMPANY'S EMPLOYEES.—The fifteenth annual outing of the officers and employees of the Jeffrey Manufacturing Company, Columbus, Ohio, took place on Saturday, June 24, in the form of an excursion to Lake Hiawatha Park, at Mount Vernon. It required two special trains of fourteen cars each to transport the party, which numbered about 1500 people. The officers and employees were accompanied by their families, and an enjoyable time was had by all. Athletics formed one of the features of the outing, including a game of ball.

THE MICA MACHINE COMPANY, of Edgewood Park, Pa., is being incorporated for the purpose of manufacturing machines for splitting and grading mica for electrical uses. These machines take the place of the present hand method of doing the same work, and reduce the cost of splitting considerably, besides grading even more closely than is done by hand. They will be sold to the large electrical companies. This machine is the result of four years' constant and hard study, and is said to accomplish its work very satisfactorily. The company controls all the foreign patents.

MESSRS. HEWITT & WARDEN.—The partnership between Messrs. W. M. Sheehan and C. E. Hewitt (Sheehan & Hewitt, electrical engineers and contractors), Newburgh, N. Y., has been dissolved, and a new partnership has been formed between Messrs. C. E. Hewitt and H. A. Warden. The new firm will do business under the name of Hewitt & Warden, and will carry on practically the same work that was conducted by the old firm, with the exception that they will make a specialty of marine engineering work, and will push the manufacture of Hewitt's series governing board.

TELEPHONE SUPPLIES make a difficult line to carry, for there is a complex multiplicity of detail that even the exchange manager often does not suspect. There is a large difference between the word "carry" and procure—one refers to getting orders promptly filled and free from substitution; the latter term covers a host of vexations, including losses from idle help and forfeited contracts. The Central Electric Company, Chicago, has made it a strong point for the last four years to select reliable material and carry in stock all standard articles required in telephone construction and maintenance.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., reports that on account of its success with the Adams-Bagnall inclosed arc lamps, it has recently been compelled to add an arc lamp department to its business. It says that in every case where it has installed A. B. lamps the results have been more than satisfactory. Mr. A. W. Dutton, who has so successfully represented the Western Electrical Supply Company for a number of years in the South, will hereafter make his headquarters at the company's office in St. Louis, and devote his entire time and attention to managing the arc lamp department.

THE ELECTRIC AXLE, LIGHT & POWER COMPANY has been incorporated at Trenton, N. J., with a capital stock of $25,000,000, for the purpose of lighting, heating, ventilating and refrigerating railway cars by means of electricity generated by power from the car axle. It is stated that this company is the outgrowth of the National Electric Car Lighting Company of New York, which controls the Moskowitz axle light patents and has its system introduced on the Atchison, Topeka & Santa Fe Railway; the Delaware, Lackawanna & Western Railroad; the New York Central; Illinois Central and Southern Pacific Railroads; Pullman, Wagner and private cars, and also on foreign roads.

THE GENERAL ELECTRIC COMPANY has just issued some interesting trade literature, consisting of a pamphlet entitled "A Trip to the Schenectady Works of the General Electric Company," bulletins Nos. 4183, 4184 and 4185, and two flyers. The pamphlet was issued on the occasion of the recent convention of the National Electric Light Association, for the information of those who visited the Schenectady works as guests of the General Electric Company. The bulletins are on inclosed arc lamps for stores and warehouses, the prepayment meter system and artificial light for machine shops and foundries. One of the flyers briefly describes compensators for fan motors, giving diagrams showing the method of connecting the device. The other flyer offers some advice to customers ordering goods.

MR. JOHN S. NOWOTNY, of 313 East Second street, Cincinnati, Ohio, requests us to announce to the public and his many friends in the electrical business and kindred lines that he severed his connection with the Nowotny Electric Company March 31, 1898. Mr. Nowotny founded the Nowotny Electric Company and managed the business from its incipiency until March 31, 1898. The assignment of the Nowotny Electric Company, which occurred June 30, 1898, in no way affects him. After severing his connection with the above named company, he immediately embarked in the manufacture of Nowotny's semi-vacuum long burning arc lamps and electrical specialties. The latter named business is owned solely by him, and operated under his personal supervision and name, and is without affiliations with the other concern.

ELECTRICITY FOR PUCK BUILDING.—Messrs. Westinghouse, Church, Kerr & Co., New York, have completed the electrical equipment of the new building in New York for the Puck Publishing Company. To provide for possible contingencies, two outfits are installed, consisting of two 75-hp Westinghouse standard engines direct connected to two 50-kw Westinghouse "engine type" electric generators. The plant is now in operation, running electric elevators and other power work, in addition to providing light for the building and offices. The two electric generators are so arranged that they work in multiple, supplementing each other when the demand for current is heavy. This method is economical, since one engine can be run when the load is light, the second being used during the busiest hours only.

GOLD CAR HEATING COMPANY, Bridge Store No. 6, Brooklyn Bridge, N. Y., have issued a new catalogue for 1899-1900, on the "Gold System" of car heating. It is a large, massive and handsome book, of about 80 quarto pages, bound in stout cloth covers, gold stamped. It includes a large number of illustrations, some of which are printed on folder sheets, and is altogether a splendid example of trade bookmaking. A great deal of the data is already familiar to our readers, but all of them will be glad to secure it in this permanent form for reference. At the end of the book are a batch of selected testimonials representing the large quantities received by the Gold Company as to the merits of their steam and electric systems of railroad and street railway heating. Such catalogues as this are a credit alike to the industry and to the company issuing them.

MR. E. V. BAILLARD, 106-108 Liberty Street, New York, has recently doubled his manufacturing facilities to accommodate his rapidly growing business. Mr. Baillard has for a number of years been in the business of manufacturing delicate instruments and fine machinery, particularly special and experimental devices. With the latter he has a wide experience and many of the ingenious devices on the market to-day have been first made at his shop. The general character of work which Mr. Baillard has undertaken to do is of the very highest grade and frequently of the most complicated character. Mr. Baillard is an able electrical and mechanical engineer and can develop from a few pencil sketches a completed working model or machine. He has also equipped his laboratory with testing instruments and electrical devices of various kinds for making any tests or measurements.

THE CREED ELECTRIC CAR HEATER COMPANY, Taunton, Mass., is manufacturing an electric car heater which, it is claimed, combines these essential features, viz.: simplicity of construction, efficiency and durability. The heater has a series of heating coils in one radiator, and warms a car quickly. The current can be regulated to suit the weather, and the consumption of current varies from 3 to 7 amperes, according to the outside temperature. These heaters are used on the Lowell & Suburban Street Railway, on the Taunton cars for the past three years; in Brockton, Providence, Fall River, New Bedford, Woonsocket and many other places, and, the company reports, are giving satisfaction. The company has never been called upon to make repairs on any of these. It states that its heater is covered by a valid patent. Mr. P. T. Creed is president of the Creed Car Heater Company. He looks forward to a very busy season.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has every reason to be gratified over its June sales. The list is a long one, and includes no less than 112 generators and motors, the motors ranging in sizes from 1¾-hp to 100-hp, and the generators in capacities from 5-kw to 100-kw. Among the orders received were complete motor printing press equipments for the Hartford *Times*, Hartford, Conn., and R. Hoe & Co., New York. We notice in the list several foreign orders, as follows: Manchester Sporting *Chronicle*, Manchester, England, one 25-hp type "N" generator; Sir Christopher Ferness, Westgarth County, Middlesboro-on-Tees, England, one 75-hp type "E" motor for direct connection to pump; Nottingham Guardian, Nottingham, England, five 6-hp type "N" inclosed motors and two printing press equipments consisting of two 40-hp type "E" motors, two 40-hp teasers, two controllers and two switchboards; Birmingham *Daily Post*, Birmingham, England, one printing press equipment, consisting of one 50-hp motor, one 50-hp teaser, one controller and one switchboard. The domestic orders came from all parts of the country. Those from electrical concerns are as follows: Southern Electrical Supply Company, St. Louis, Mo., one 50-kw engine type generator, one 25-hp type "H" motor, one 12.5-kw type "H" generator; West Branch Electric Light Company, West Branch, Iowa, one 22.5-kw type "H" generator; Central Electric Company, Chicago, Ill., one 75-kw type "H" generator; Royal Electric Company, Quebec, Canada, two 30-kw type "H" generators, and the Muscatine Electric Railway Company, Muscatine, Iowa, one 5-hp type "H" 500-volt motor.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JULY 4, 1899.

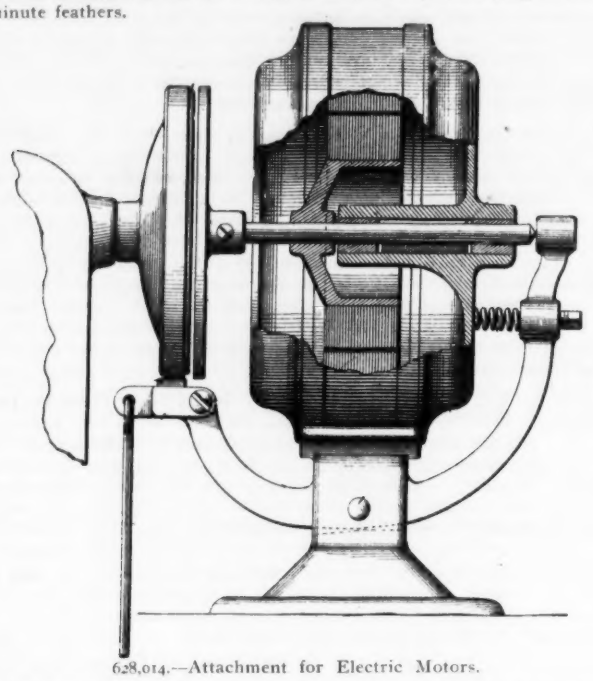
[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

627,941. STREET INDICATING DEVICE. F. E. ROTHBALLER, Syracuse, N. Y. App. filed Dec. 31, 1898. The device is operated by making an electrical contact from the trolley wire as the car approaches the street.

627,997. AUTOMATIC MAGNETIC CIRCUIT BREAKER; P. R. Goldey, Philadelphia, Pa. App. filed Oct. 26, 1898. A suspended weight is released by the magnet acting through a peculiar trigger device, and the fall of the weight actuates a circuit controlling lever.

628,014. ATTACHMENT FOR ELECTRIC MOTORS; C. S. Nestorn, St. Louis, Mo. App. filed Nov. 28, 1898. The essential feature of this invention resides in the arrangement of a friction disk or clutch on the shaft to be driven with which co-operates a friction disk driven by the armature shaft; also a brake which serves to retard the driven shaft while at the same time opening the clutch and vice versa.

628,026. METHOD OF CONTROLLING HIGH TENSION CURRENTS; H. G. O'Neill, New York, N. Y. App. filed Oct. 18, 1898. The principle involved consists in interposing in circuit the resistance offered by a vacuum and a wall of glass, thereby obtaining any desired reduction in electromotive force and also such attenuation of the current as to permit its use in a flattened out form with a mild effect, resembling a shower of minute feathers.

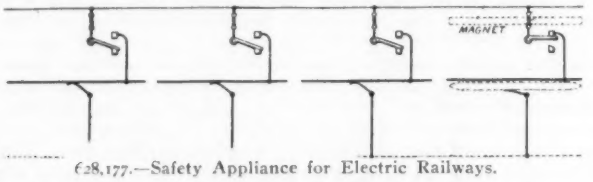


628,014.—Attachment for Electric Motors.

628,036. SECTION CIRCUIT CLOSER; F. M. Prokof, Hamburg, Germany. App. filed Jan. 28, 1897. A signaling apparatus for railways, consisting of two devices placed below one of the rails a certain distance apart, each provided with a vertically sliding bolt, one end of which abuts against the foot of the rail and the other upon an unequally armed lever and operated by the sagging of the rail under the weight of the car. This lever is in communication with contact devices so that one operates on the passage of a train in one direction closes the contacts, while the other operates on the passage of a train in the opposite direction prevents such closure.

628,046. REPEATING AND TRANSMITTING TELEPHONE; G. K. Thompson, Malden, Mass. App. filed Nov. 29, 1898. (See Current News and Notes.)

628,050. ARMATURE FOR DYNAMO ELECTRIC MACHINES; A. H. Wait, Chicago, Ill. App. filed June 10, 1898. Each groove in the iron clad armature is provided at its longitudinal opening with a number of lugs integrally with the core. These hold the wires in the grooves and dispense with band wires; they also reduce the self-inductive effect of the coils.



628,177.—Safety Appliance for Electric Railways.

628,068. TELEPHONE SYSTEM; W. W. Bennett, Mesquit, Texas. App. filed Dec. 1, 1897. A device intended for use in systems wherein a number of instruments are in the same main line circuit, and is intended to prevent subscribers from overhearing the conversations of others on the same line. Two receivers are used, the section of the circuit over which conversation is to be carried on being determined by the particular receiver chosen.

628,078. MAGNETIC SEPARATOR; A. Dings, Milwaukee, Wis. App. filed April 20, 1899. A disk carrying a number of magnets overhanging a conveyer belt and circuit closers are used for automatically closing the circuit of the magnets while they are over the belt and opening said circuits while the magnets are otherwise located.

628,109. ALTERNATING CURRENT ARC LAMP; G. L. Moyer, Hartford, Conn. App. filed April 25, 1899. The arc is started slowly by a weak magnetic influence, and after the carbons become heated and the resistance of the arc is increased is completed by a spring magnetic influence.

628,113. APPARATUS FOR INDICATING THE NUMBER OF CONVERSATIONS OVER TELEPHONES; C. Petersen, Copenhagen, Denmark. App. filed July 20, 1898. In sending a signal the subscriber inflates a bellows which moves an indicator and so makes a record of the number of calls.

628,115. CARBON CONTACT; E. Pettet, Farmer City, Ill. App. filed Feb. 27, 1899. A cut-out device in which spring-mounted carbon electrodes are held apart normally by a sheet of paper which under abnormal conditions is burned, allowing the contacts to come together.

628,116. GALVANIC BATTERY; J. Poppenburg, Charlottenburg, Germany. App. filed Nov. 7, 1898. A battery capable of being transported and kept for a long time when dry, and of being rendered fit for use immediately by the addition of water.

628,177. SAFETY APPLIANCE FOR ELECTRIC RAILWAYS; M. Hoopes, Lynn, Mass. App. filed June 15, 1896. The object is to prevent a sectional rail being left alive after the passage of a car.

628,180. CUT-OUT PLUG; A. Johnston, Jersey City, N. J. App. filed March 25, 1898. Details of construction, whereby the fuse may be readily put in place and perfect electric contact made with the terminals of the plug without the use of solder.

628,240. ELECTRIC METER; T. Duncan, Fort Wayne, Ind. App. filed April 5, 1899. (See Current News and Notes.)

628,245. DYNAMO ELECTRIC MACHINE; M. Hutin and M. Leblanc, Paris, France. App. filed April 10, 1897. (See page 80.)

628,246. TELEPHONY; M. Hutin and M. Leblanc, Paris, France. App. filed Dec. 6, 1897. (See Current News and Notes.)

628,247. MULTIPLE TELEPHONY AND TELEGRAPHY; M. Hutin and M. Leblanc, Paris, France. App. filed Dec. 30, 1897. (See Current News and Notes.)

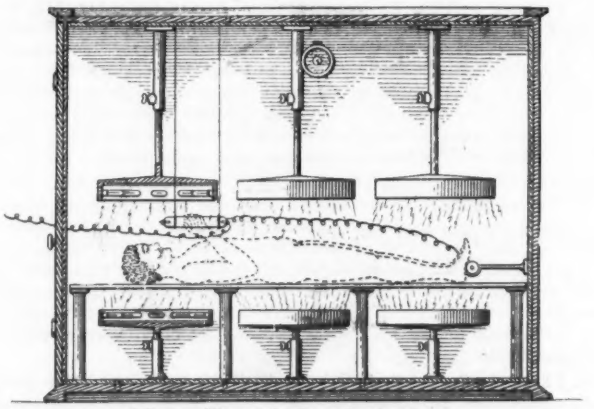
628,299. APPARATUS FOR SIGNALING UPON RAILWAYS; W. Brierley, Nelson, England. App. filed Dec. 29, 1897. A lever is arranged in the engine cab to be struck by a projection on the permanent way and thereby give an audible signal to the engineer.

628,300. APPARATUS FOR SIGNALING UPON RAILWAYS; W. Brierley, Nelson, England. App. filed Jan. 6, 1898. A modification of the preceding, in which the same lever is used but in connection with electromagnetic apparatus.

628,343. FIXING OF INSULATORS FOR CARRYING ELECTRIC LINE WIRES; W. Mengel, Dusseldorf, Germany. A stem or pin for insulators, screw-threaded throughout a portion of its length at the end thereof, where it engages the insulator, a series of independent angular grooves passing around the body of said pin at right angles to its longitudinal axis and commencing where the screw-threaded portion ends.

628,351. ELECTROTHERAPEUTIC APPARATUS; H. G. O'Neill, New York, N. Y. App. filed Oct. 15, 1898. The principle involved consists in subjecting a new body to actinic rays of light and oscillating the sine curve in the presence of an atmosphere of nascent ozone.

628,352. VACUUM ELECTRODE FOR THERAPEUTIC APPARATUS; H. G. O'Neill, New York, N. Y. App. filed Oct. 15, 1898. A unipolar electrode of glass containing a vacuum chamber, having an exterior contact surface and a single sealed-in terminal designed for connection with a source of high tension electricity.



628,351.—Electrotherapeutic Apparatus.

628,358. METHOD OF AND APPARATUS FOR VARYING THE NUMBER OF PHASES OF POLYPHASE CURRENTS; H. A. Rowland, Baltimore, Md. App. filed July 16, 1894. (See Current News and Notes.)

628,429. METHOD OF HEATING METALS BY ELECTRICITY; E. M. Bentley, Boston, Mass. App. filed Aug. 20, 1890. (See Current News and Notes.)

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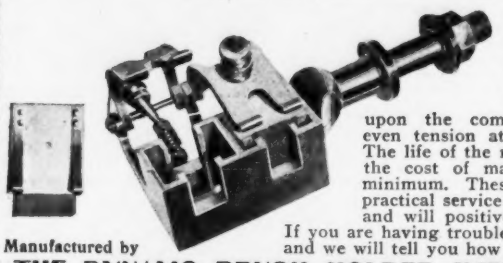

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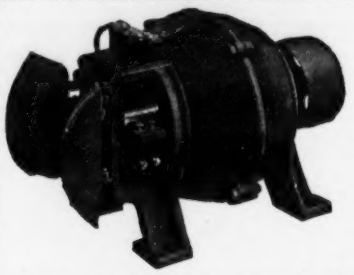

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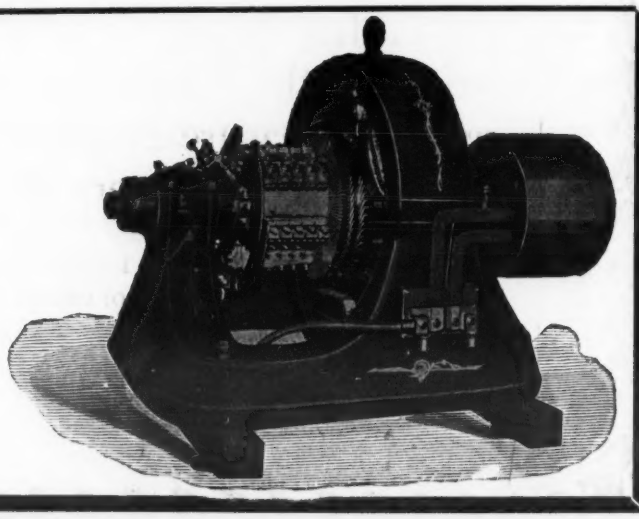

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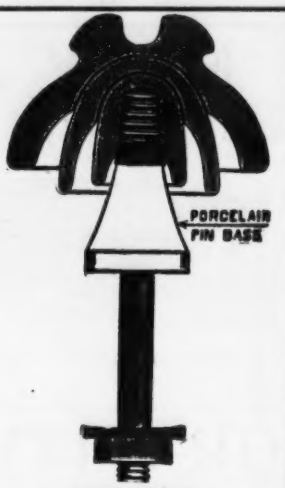

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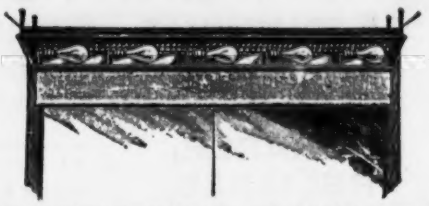

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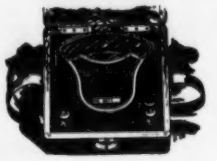

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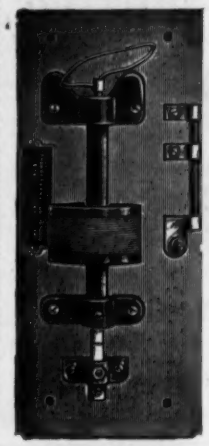

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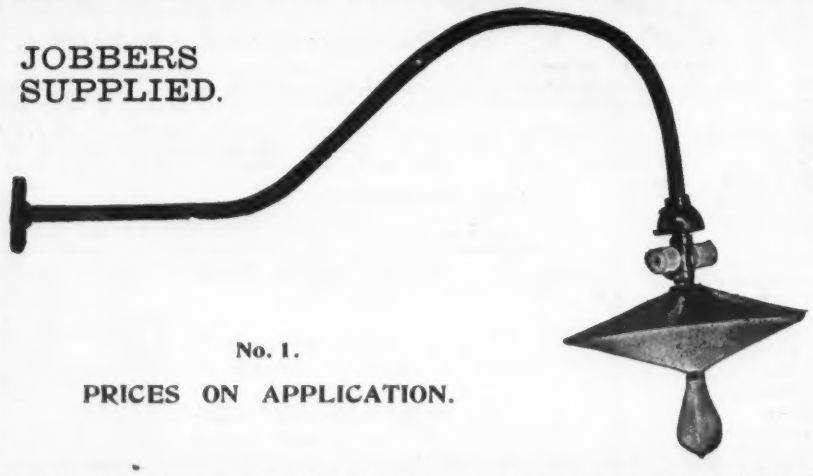

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